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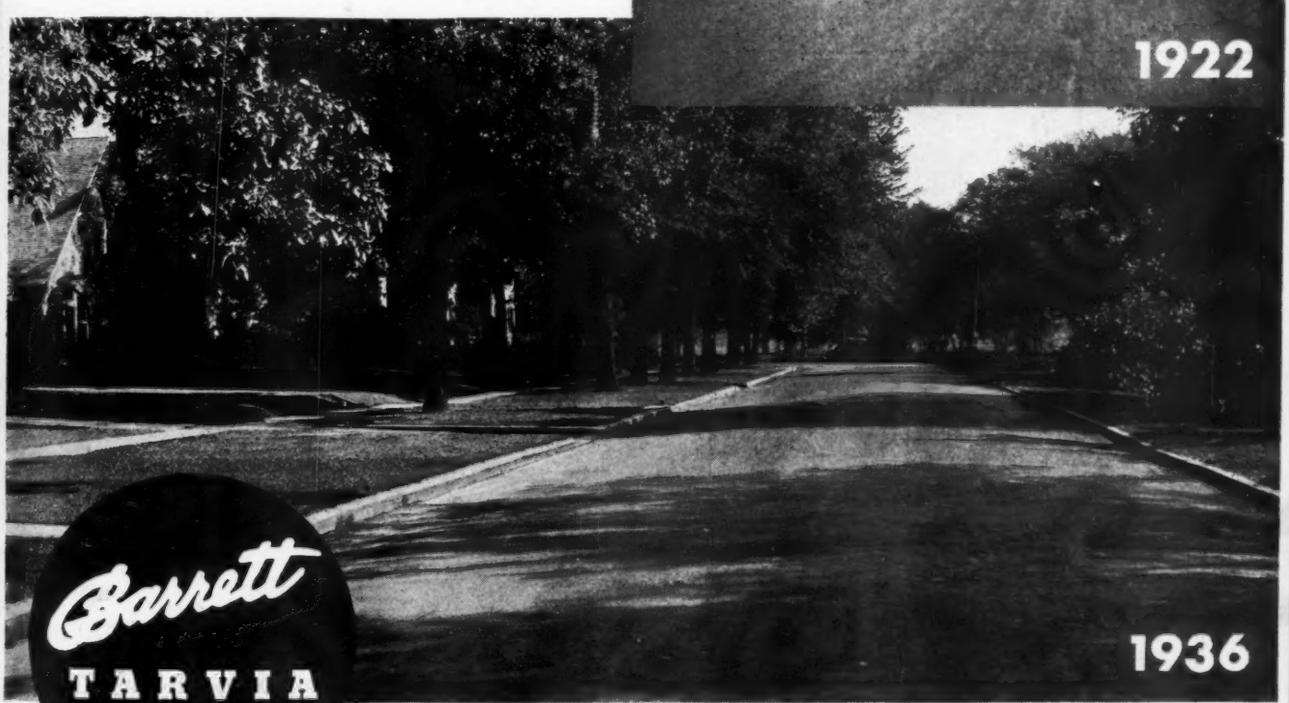
PUBLIC WORKS

City, County and State

Harlem Boulevard, Rockford, Illinois. Tarvia-built in 1922. The slightly granular surface of the road is as effectively skid-safe today as it was fourteen years ago.



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SEPTEMBER, 1936

VALVES HYDRANTS VALVE BOXES

Fig. 72-73

Fig. 67-A. W. W. A.

Fig. 74-75

Fig. 29H-A. W. W. A.

FIRE HYDRANTS . . .

A. W. W. A. Standard

SPECIFICATIONS

Compression type. Main valve remains closed if hydrant broken off. **Automatic drain** with two valves. **Revolving head:** nozzles can face any direction. **Dry top,** as operating threads are above stuffing box. **Fully bronze-mounted:** no iron-to-iron contacts of moving parts. MATERIALS: iron parts have minimum tensile strength of 30,000 pounds per square inch. Bronze parts ditto 70,000 lbs. **Non-freezing. Leak-proof:** double lead seat water-seal. **Tested,** all parts and completed hydrants, to 300 lbs. hydrostatic pressure. A.W.W.A. standard in every respect.

Write for booklet, full data.

In Ordering Hydrants

Specify (1) diameter of valve opening (2) size, kind of pipe to connect with (3) trench-depth at hydrant (4) number 2½-inch hose connections (5) if steamer connection, state inside diameter (6) description of hose threads (if not National Standard, send male hose coupling) (7) description of threads on steamer connection, giving O.D. and number-per-inch (8) size, shape operating nut (9) direction turn to open (10) color to paint hydrants.

Specifications for M. & H. A.W.W.A. Double Disc Parallel Seat Gate Valves

BODY AND BONNET made of special mixture pig iron and steel, producing a close-grained Ferro-Steel with tensile strength of not less than 30,000 lbs. per square inch. Heavily proportioned throughout.

STUFFING BOX is of same quality as body, with ample packing-space.

GLAND, one-piece Ferro-Steel. Bronze-bushed when specified.

OPERATING NUT is Ferro-Steel 2-inches square.

STEM made of Manganese Bronze, tensile strength 70,000 lbs. per square inch. Rising or non-rising type.

DISCS, Ferro-Steel, to withstand combined pressures wedging mechanism and water.

DISC AND BODY RINGS, Bronze of 35,000 lbs. tensile strength, minimum. Faces of seats machined and lapped. Water-tight.

WEDGING MECHANISM. Manganese Bronze of 70,000 lbs. minimum tensile strength. Distributes pressure equally on discs through 3-point contact.

BOLTS AND NUTS are of high-tensile steel. Square heads. Hex nuts.

TESTING AND PAINTING. All valves tested to 300 pounds per square inch hydrostatic pressure.

Write for folder 31-S.

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VALVE BOXES

Full line. All depths. Write for folder.

Fig. S-517

M&H VALVE AND FITTINGS CO. ANNISTON, ALABAMA

VOL. 67 PUBLIC WORKS No. 9

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SEPTEMBER, 1936

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TIMEWASTERS

The weather is too hot for timewasting in this strenuous fashion; fishing, or just loafing, is better. There should be a closed season so that the victim of this column could now and then collect a few problems and get ahead of the game.

Quite a few of the ladies and gentlemen who play around with this column have enjoyed our marbles series, and so Mr. Anderson from Michigan comes through with another, only these are rather large marbles; maybe they are billiard balls.

Four of Them:

What is the diameter of the smallest sphere to enclose four balls whose diameters are 3 inches each?

A Pipe Problem:

A superintendent bought a lot of 4, 6, 8, 10, 12 and 16-inch pipe. At the end of the season, he found that:

He had 101 feet of 4-inch left;

That he had laid one-fifth as much 6-inch as 4-inch and had one foot of 6-inch left on hand;

That he had laid one-fifth as much 8-inch and 6-inch and had 6 feet of 8-inch left on hand;

That he had laid one-fifth as much 10-inch as 8-inch;

That he had laid one-fifth as much 12-inch as 10-inch;

That he had laid one-fourth as much 16-inch as 12-inch;

That he had no 10-inch, 12-inch or 16-inch left.

What was the smallest amount of pipe of the various sizes he could have purchased?

It's Universal

Several of the folks in our little group of serious thinkers report that they don't dare tackle the Red Cross problem because quarters are so scare in their vicinities. [See July issue.]

Solutions and Answers:

The answer to the marble problem submitted by Mr. Wheeler is 0.8038 inches. The proper payments to be made by the two brethren attending the convention is $2.10 and 70c. The four numbers to be multiplied by 7 are: 3094; 4093; 9304 and 9403. When multiplied by "7" all digits are present in the multiplier, multiplicand and product. W. A. H.

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A. PRESCOTT FOLWELL, Editor — **W. A. HARDENBERGH,** Asso. Editor

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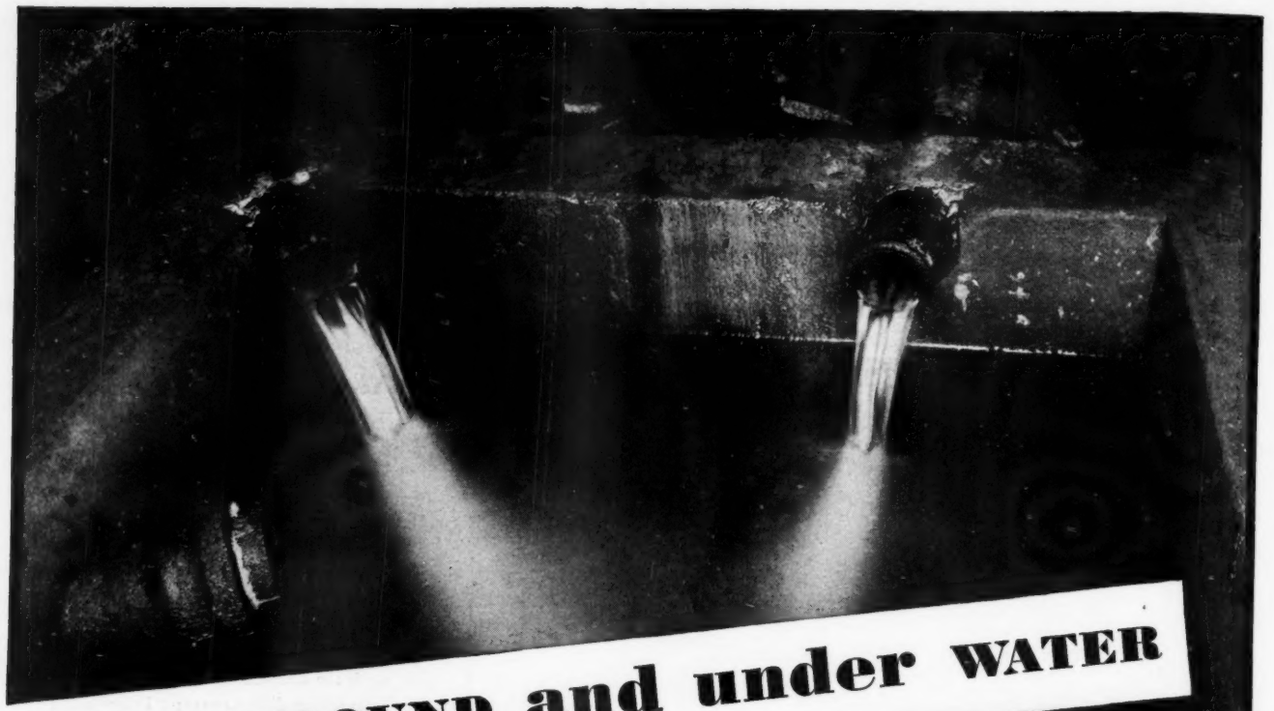
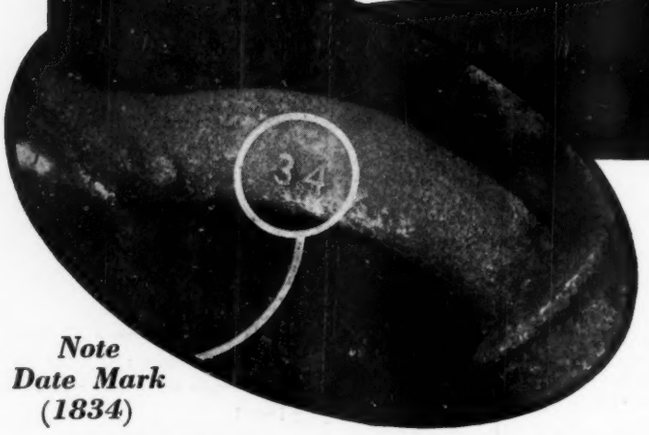
FOUNDED IN 1896



Under GROUND and under WATER for 102 years



Note Date Mark (1834)

Arrow points to cast iron pipe installed in 1834 to carry water from Hampden Springs to the then Borough of Reading, Pa.

ON A HILL above Reading, Pennsylvania, a never-failing spring still furnishes part of the city's water supply. Earthen pipes were used from 1815 until 1824, then wooden pipes until 1834 at which time cast iron pipe was installed and is still serving, under ground and under water. In many cities, here and abroad, cast iron pipe installed from one to nearly three centuries ago continues to render satisfactory service. Recorded facts prove that cast iron pipe serves longest, costs less per service year and least to maintain.

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PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 67 | *September, 1936* | No. 9

The Water Resources of New England

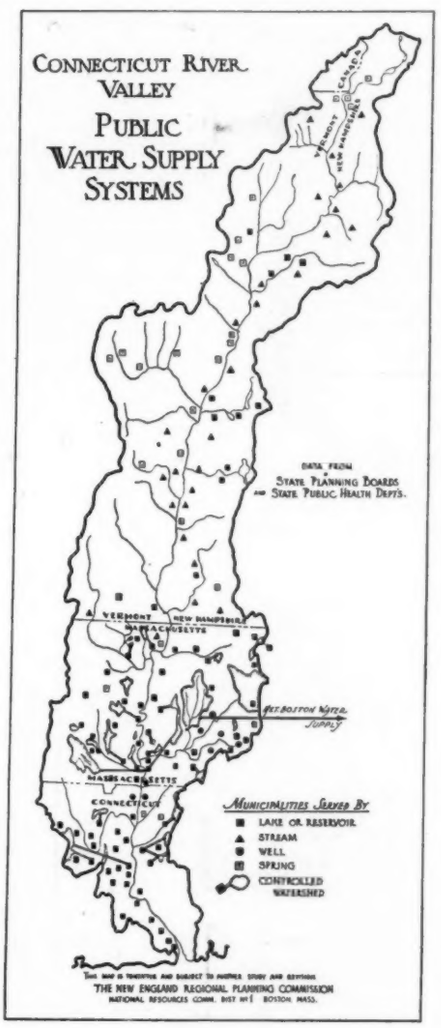
Existing conditions and problems on three interstate rivers—the Connecticut, Merrimack and Blackstone

THERE are in New England 19 principal river systems (excluding coastal streams), 9 of which flow through more than one state. Of these interstate streams, the New England Regional Planning Commission considers three to be of major interstate significance—the Connecticut, Merrimack and Blackstone Rivers. The staff of the Commission has made preliminary studies and reports on existing conditions and problems in these river valleys, and has submitted them to the Water Resources Committee of the Commission. A summary of these data has been published by the National Resources Committee.

The Connecticut River

The Connecticut river valley, extending into four states, covers the greatest area and has the largest population of all the drainage areas in New England. Also, there is more water power, both developed and undeveloped, on the Connecticut river than on any other two rivers in New England. The Connecticut drainage area comprises about 11,320 square miles, of which 115 square miles are in Canada. The population, which is about 1,230,000, represents 15% of the total in New England. Located in the valley are all, or parts, of 355 towns or cities, including 20 with a population of more than 10,000.

Water Supply.—There are 147 municipalities having public water supply systems, most of which are from surface waters; the rest depend upon underground sources. In addition, a large area is being developed as a water supply for the Boston metropolitan water district. Many of the systems include treatment plants; others rely for purification on storage or natural watershed protection. The water supply problem is interstate in scope, inasmuch as the taking of water from a river or its tributaries alters the flow and affects, in varying degrees, power and industrial plants below the point of diversion.



The distribution of water supply systems and their classification according to types of sources is shown below. Of the towns in the watershed that have over 1,000 inhabitants, there are 24 which do not have public water supply systems.

Stream Pollution.—The sources of polution on the river and its tributaries are shown on page 10. Of the 97 public sewerage systems in the valley serving 10 or more families, with an estimated population thus served of 835,000, or about 70 percent of the total, 82 discharge raw sewage directly into the main river; the sewage from 13 other systems reaches the river after receiving partial treatment; and 2 systems include complete treatment.

The State of Connecticut has a well-established policy regarding pollution of the river. At present the large communities which have in the past discharged sewage into the stream, are, with one exception, now building sewage treatment plants. By contrast, in Massachusetts the large cities are still discharging raw sewage into the stream.

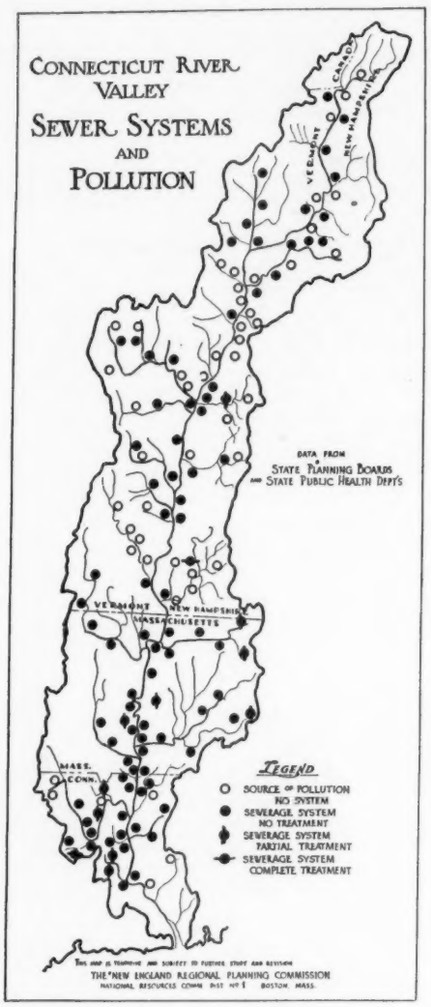
Stream Flow.—The stream flow of the Connecticut Valley is obtained at 46 gaging stations, 10 of which are on the main river, and the remainder on 16 of its major tributaries. More than half of these stations have records of 10 or more years and show an average rate of run-off of 1.67 cubic feet per second per square mile. The records show the run-off to vary from nothing on many of the smaller streams during dry periods to a maximum 24-hour rate of 60 cubic feet per second per square mile. This occurred on the south branch of the Ashuelot River during the flood of 1927.

The wide variation between low and flood flows results in economic losses which can be lessened and, in some cases, prevented, by the construction of storage reservoirs or basins. Such reservoirs would make possible the regulation of

the river during dry seasons and the reduction of the peak flow of the river during floods.

Merrimack River

While the drainage area of the Merrimack river, of about 5,000 square miles, is slightly less than half that


CONNECTICUT RIVER VALLEY
SEWER SYSTEMS AND POLLUTION
DATA FROM STATE PLANNING BOARDS AND STATE PUBLIC HEALTH DEPT'S
LEGEND
SOURCE OF POLLUTION NO SYSTEM
SEWERAGE SYSTEM NO TREATMENT
SEWERAGE SYSTEM PARTIAL TREATMENT
SEWERAGE SYSTEM COMPLETE TREATMENT
THE NEW ENGLAND REGIONAL PLANNING COMMISSION
BOSTON, MASS.

of the Connecticut, the greater density of its population, especially in the lower half of the watershed, intensifies its problems. Nearly 70 percent of the people in the Merrimack valley (about 811,000) are in the 16 cities of over 10,000. These cities contain over 1,400 manufacturing establishments, with a total value of products in 1933, of nearly 300 million dollars.

Water Supply.—The Merrimack river drainage area is the largest source of public water supply in New England, supplying nearly 2½ million people living in 208 communities located both within and beyond the boundary of the drainage basin. The quantity of water supplied amounts to nearly 70 billion gallons a year—equivalent to the run-off from about 100 square miles of drainage area.

One hundred and nineteen of these municipalities are located in the drainage basin: 80 receive their water from surface waters, 30 from ground water, and 9 from both sources. They are supplied by 106 public systems, 37 of which include treatment.

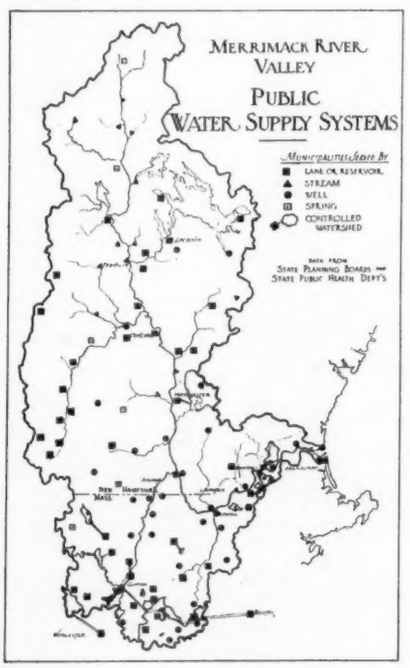
Stream Pollution.—The problem of freeing the Merrimack valley from pollution by sewerage and industrial wastes is of considerable importance. Ten cities, including 7 with a population of 10,000 or over, discharge untreated sewage directly into the river. Six of these cities are located upstream from Lawrence, which obtains its domestic supply directly from the river, filtration and chlorination being employed to render the water safe. Other streams that receive a great quantity of untreated sewage are the Winnepesaukee, Contoocook, Nashua, Concord and Shawsheen rivers.

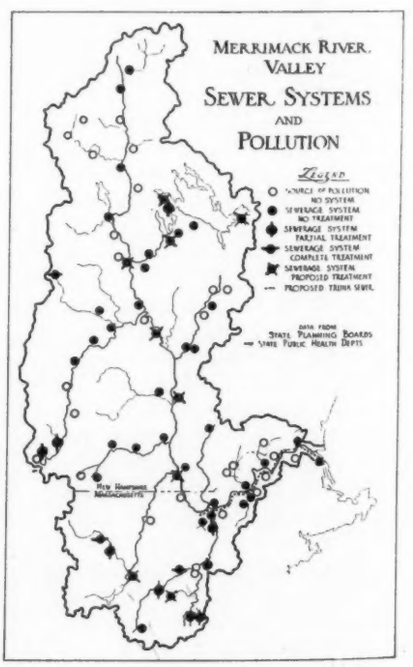
Stream Flow.—The stream flow of the Merrimack river and its tributaries is measured at 20 stations, 14 of which have records of ten years or more. The average annual run-off for these 14 stations is 1.53 cubic feet per second per square mile. Although the flow has been practically nothing on several of the smaller streams during dry periods, it reached a maximum 24-hour average of 65 cubic feet per second per square mile on the Pemigewasset river during the 1927 flood.

Flood damage in the Merrimack basin occurs chiefly on the Pemigewasset branch and on the main river below its junction with the Winnepesaukee river. The latter has a fairly well regulated flow due to the storage capacity in Winnepesaukee and Squam lakes. The regulation of stream flow, for both high and low water conditions, is urgently needed on the Merrimack.

Blackstone River

The Blackstone river valley, with a drainage area of approximately 545 square miles, has less than one-twentieth the area of the Connecticut, yet it has nearly one-third as great population. It is the most densely populated watershed in New England, with more than 1,000 people per square mile, and it is also highly industrialized. There are, in proportion to its area, so many water power developments on the Blackstone that its problems are highly significant to both Massachusetts and Rhode Island.




MERRIMACK RIVER VALLEY
SEWER SYSTEMS AND POLLUTION
LEGEND
SOURCE OF POLLUTION NO SYSTEM
SEWERAGE SYSTEM NO TREATMENT
SEWERAGE SYSTEM PARTIAL TREATMENT
SEWERAGE SYSTEM COMPLETE TREATMENT
SEWERAGE SYSTEM PROPOSED TREATMENT
PROPOSED TRUNK SEWER
DATA FROM STATE PLANNING BOARDS AND STATE PUBLIC HEALTH DEPTS

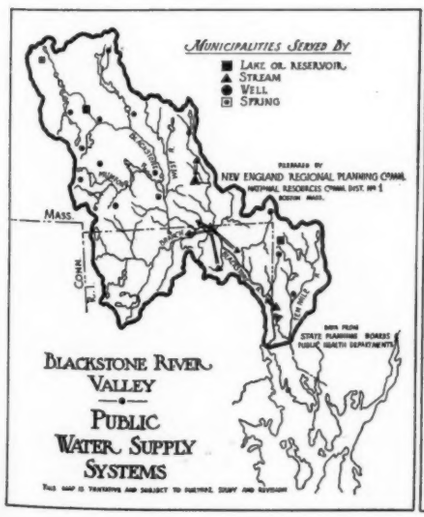
Water Supply.—There are 22 cities located within the watershed which have public water systems. Of these, more than half are supplied by wells, the remainder by surface waters. There are few sites available for new water-supply reservoirs, and any considerable extension of water systems would require the utilization of underground sources.

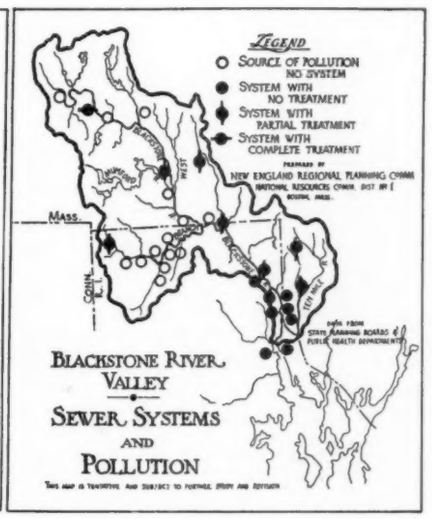
Stream Pollution.—Both industrial and domestic wastes are discharged into the river in such volumes that it is polluted throughout its entire course. Of the eight sewerage systems which discharge into the river, the larger ones treat the sewage before it is discharged, but the only system that includes complete treatment is that of Worcester.

The Rhode Island metropolitan sewer commission has prepared plans for a sewage-disposal system and treatment plant which would serve all the Rhode Island communities in the Blackstone Valley except those on the upper Branch river, and would dispose of the sewage from over 200,000 of the population.

The accompanying map shows the known sources of pollution on the Blackstone river.

Stream Flow.—There are two gaging stations on the Blackstone river, one at Worcester, Mass., established in 1923, serving a drainage area of 31.5 square miles; and a second at Woonsocket, R. I., established in 1929, serving a drainage area of 415 square miles. The records at the Worcester station show a mean annual run-off of 1.54 cubic feet per second per square mile, with a recorded minimum flow of 0.3 cubic feet per second and a maximum of 935 cubic feet per second. At Woonsocket, the mean annual run-off during the years of record is 1.51 cubic feet per second per square mile, the minimum being 7 cubic feet per second and the maximum 9,760 cubic feet per second. At the time of the 1927 flood, the estimated peak discharge at Woonsocket was about 14,500 cubic feet per second.





During the dry season, because of the low flow above the Worcester sewage disposal works, the volume of water is approximately the same as that of the treated sewage discharged into the river from these works. The dilution afforded by this treated sewage has actually assisted in solving the pollution problem of the river.

The problem of floods on the Blackstone is not serious. Floods have not produced excessive losses either of property or life and, generally speaking, the

property damages have been confined to the industrial plants along the river banks.

Other Interstate Streams

Although the problems of water supply, pollution, power, and flood control assume their greatest importance on the three major interstate streams, these problems are present on all streams and must be considered in planning for the conservation and development of New England water resources.

The Commission confines its studies to interstate streams, except where the development of the resources of an intrastate stream involves the interests of adjoining States. Otherwise the Commission considers planning for intrastate streams to be under the jurisdiction of the State planning boards.

In general the streams in southern New England offer problems concerned mainly with water supply and pollution while the streams in Vermont and New Hampshire and, to a lesser extent, in Maine, present problems of power and flood control.

The rivers in Vermont which are tributary to Lake Champlain present acute flood problems owing to the lack of storage and the steep and partly denuded slopes of the Green Mountains. After making exhaustive engineering studies of these conditions, the advisory committee of engineers on flood control for Vermont, in 1928-30, suggested many sites for the location of storage reservoirs. Of the reservoirs recommended, three have already been constructed on the Winooski river at East Barre, Waterbury, and Wrightsville by the Civilian Conservation Corps. The State of New Hampshire has carried out similar studies and made plans covering the more important rivers of that State.

Interstate Compacts

The Commission has studied the possibilities of cooperative interstate development of water resources. The recommendations were that enabling bills should be passed by Congress to provide for, and encourage the adoption of, interstate compacts as the basis for this work. Interstate compact commissions have been set up in New Hampshire, Connecticut, Vermont and Massachusetts, and a joint meeting was held in Boston in June.

Studies of Small Dams

To improve procedures relating to the design and construction of small dams and water storage projects, the National Resources Committee has announced that a group of experts has begun work intended to coordinate Federal efforts in these directions.

The sub-committee named by the Water Resources Committee of the National Resources Committee is composed of the following: R. W. Davenport, U. S. Geological Survey; E. C. Fortier, Bureau of Indian Affairs; Perry Fellows, Works Progress Administration; C. S. Jarvis, Soil Conservation Service; L. A. Jones, Bureau of Agricultural Engineering; T. W. Norcross, Forest Service; E. F. Preece, National Park Service; P. I. Taylor, Bureau of Reclamation; Thorndike Saville, College of Engineering, New York University, Chairman.

Formed as a result of a conference among representatives of Federal agencies interested in the construction of small dams, called at the request of the National Park Service, the sub-committee is undertaking two investigations. A manual of procedure for the design and construction of small dams will be prepared to replace the several departmental manuals now in use. M. B. Arthur of the Forest Service has been loaned to the sub-committee of the Water Resources Committee to prepare the first draft of this manual which will correlate the procedures and ideas of the several Federal agencies concerned.

Freezing Troubles in Indiana Municipalities

Freezing Troubles In Indiana Towns & Cities For Winter Of 1935-36 As Reported At The 29th Annual Meeting Of The Indiana Section Of The American Water Works Association At Purdue University, Lafayette Indiana April 7-8-9, 1936

Place	Frozen Meters: Pits	Basement	Total	%	Frozen Services: Number	%	Normal Cover: Mains	Services	Inspection Of Service Cover	Means Of Protecting Meters	Frost Penetration: Sandy Soils	Clay Soils	Pumpage Increase On Account Of Water Waste	Was Service Interrupted	Any Taste Or Odor-Remedy	Frozen Mains	Frozen Hydrants	Main Breaks Account Of Freezing
Bedford	50	240	290	7.5	879	23	30"	28"	No	No	-	36"	8 M.G. for Feb.	No	No	3	38	7
Bloomington	300	100	400	9	600	13	36"	30"	Yes	Set In Meter Pit	-	42"	0.5 M.G.D.	No	Yes - Carbon	2	10	1
Columbus	-	-	75	12	275	9.17	48"&72"	8"&48"	-	-	-	48"	100%	Almost	Yes - Carbon	3	-	1 Yr. Serv. Brks.
Crawfordsville	177	138	315	12.1	276	8.7	42"	36"	Main To P.L.	Set In Meter Pit	-	48"	50%	No	Yes	0	7	0
Danville	50	10	60	9+	230	35+	-	-	-	-	40"	40"	100%	No	No	Few	0	0
Elkhart	15	30	45	.0055	400	4.9	60"	54"&48"	Neglected	Meter Mittens & Cover	60"	-	100%	No	Yes-Flushing	11	5	50
Evansville	1054	181	1135	4.9	684	2.7	36"&48"	36"&48"	Yes	No	36"	36"	132.56 M.G.	No	No	2285 of 2"	None	None
Ft. Wayne	-	-	1244	4.4	2500	8.8	48"&54"	-	Main To P.L.	No	54"	48"	4.02 MGD for Feb	No	Yes-Carbon	31	100	31
Galveston	4	2	44	26	50	33⅓	40"	30"	No	No	-	36"	3 Times Normal	No	No	None	None	None
Gary	None In Serv.	1100	1100	7.76	315	2.11	66"	36"-24" 42"-Less	No	Suggest Box & Sawdust	54"	60"	1000 GPM	No	No	None	None	None
Goshen	6	225	231	7.5	325	10.5	54"	60"	No	Electric Heater	54"	60"	7%	No	No	1	6	None
Indianapolis	1446	3653	5099	7.0	2000	2.75	50"	54"	Yes	No	50"	48"	15% to 20%	No	Slight Ammonia Carbon	24	6	19
Jasonville	26	0	26	14	26	14	36"	30"	Yes - 30"	No	-	30"	25%	No	No	1	0	3
Kendallville	20	70	90	5	35	2	60"	36"&60"	Yes	Pack	40"	40"	-	No	No	0	2	0
La Porte	8	25	33	2.75	100	3	60"	54"	No	No	-	54"	25%	No	Yes-Chlorine	5	0	5
Ligonier	22	4	26	3	25	3	54"	48"	No	No	60"	54"	70%	No	No	2	3	1
Marion	713	25	738	12.3	75	1.2	60"	40"	Yes	Use Pits	40"	30"	No	No	No	1	4	0
Michigan City	41	186	227	4.3	517	9.7	54"	48"&60"	No	No	63"	-	3½ Times Normal	No	No	3	12	3-32 Serv.
Newburgh	22	0	22	7	35	20	22"	18"&28"	No	Use Pits	30"	30"	25%	No	No	4	1	27
Noblesville	125	25	150	12.5	327	25	48"&54"	36"&48"	Yes	-	48"	-	50%	No	No	9	15	5
Osgood	67	0	67	31.1	67	3.3	20"	20"	Yes	-	37"	28"	4800 to 24000 GPD	Yes - Main Break	No - Used Carbon	3	3	8
Richmond	66	246	312	-	55	0.6	54"	48"	Yes	Boxes Recommended	-	45"	500,000 GPD	No	No	1	0	1
Rochester	35	21	76	6.5	62	6	54"	48"	No	No	52"	30"	7%	No	No	5	2	5
Rockport	0	0	0	0	10	1.5	36"	36"	Yes	Use Pits	32"	30"	Yes	No	No	1	0	0
Scottsburg	2	0	2	1.5	1	.002	36"&42"	-	Yes	Use Pits	-	24"	20%	Yes Main Break	No	2	0	2
Terre Haute	1210	210	1420	11.4	30	0.2	48"&54"	48"&54"	No	Lantern at Meter	60"	-	20%	No	Yes - Carbon	3	1	1
Union City	122	12	134	10	280	11	48"	30"	Past 6 yrs.	No	54"	48"	25%	No	No	3	3 Breaches	4
Valparaiso	0	100	100	5	150	7.5	48"	48"	Yes	No	54"	48"	1.5 MGD Excess	No	No	8	15	50
Washington	170	20	190	10	280	10	54"	30"	No	Water Co. Specifies Location	30"	22"	40%	No	Slight Deviation	0	0	0

Hollywood St., Warren, Ohio, Aug. 3, 1936.

After construction of bituminous retread, Aug. 13, 1936.

Bituminous Re-Tread of Ashed Streets in Warren, Ohio

By W. S. HARVEY
City Engineer, Warren, O.

THE city of Warren, Ohio, has a population of 41,062 as recorded in the 1930 census, having shown an increase of 14,012 in 10 years, or 51.8%. During the decade 1910 to 1920 it increased 144.1 per cent in population. This growth marked the change from an old residential and farming town to an industrial city, caused by the opening up of the Trumbull Steel Company and the many varied smaller industries which usually follow a large steel plant. Since 1910, public improvements of all kinds were carried out continuously until 1930 when, owing to the financial depression, practically all improvements carrying assessments were halted.

At the present time Warren, Ohio, has 120 miles of streets, consisting of the following types:

Brick	35.8 miles
Reinforced Concrete	5.8 miles
Sheet Asphalt	7.6 miles
Bituminous Macadam	6.1 miles
Ashed	49.2 miles
Dirt	15.5 miles

At the time of the inception of the CWA in November, 1933, this city had 19 miles of ashed streets and 28 miles of dirt streets in the outlying residential districts. As the grading and ashing of these dirt streets would employ a large number of men with a minimum of material, and being called upon to put men to work quickly, CWA projects were submitted and approved for the grading and ashing of many miles of these dirt streets.

In the spring of each year all ashed streets receive an application of dust-laying asphaltic road oil which is paid for from the gasoline tax fund. This dust-laying treatment varies in cost between 3 cents and 5 cents per lineal foot of street treated for a width of 18 feet, depending upon the market price of road oil. The annual application of the asphaltic road oil has the tendency to form a hard waterproof mat, particularly on the streets that have been under traffic for some time and are well consolidated. The formation of this mat was sufficient proof to the writer that all these thoroughly consolidated residential ashed streets would be well able to hold up under traffic if given an adequate bituminous treatment.

The continual drain on the gasoline tax fund for the annual dust-laying oil and the general maintenance of these ashed streets became the incentive to experiment with the construction of a hard top by the re-tread method. Accordingly last year four ashed streets were treated, using the following unit quantities of priming oil, blast furnace slag and asphaltic cut back:

.4 gal. per sq yd. priming oil C.O-1 (Ohio State Highway specifications).
150 lbs. per sq. yd. No. 4 blast furnace slag for base.
1.1 gal. per sq. yd. asphaltic cut back A.C.B-2 (Ohio State Highway specifications).
20 lbs. per sq. yd. No. 6 blast furnace slag for seal coat.
.3 gal. per sq. yd. asphaltic cut back for seal coat.

The primer and asphaltic cut back were applied by the usual type of pressure distributor and the blading carried out with ordinary road graders. The rolling was done with a three wheeled gasoline roller weighing 7 tons. Each street was re-treaded to a width of 16 feet.

Before the above streets were completed the property owners on numerous other ashed streets petitioned City Council to proceed with further improvements of similar type. As gasoline tax funds were depleted, and no other funds were available, the property owners on four streets volunteered to subscribe funds for the purchase of a portion of the material if the city would provide the balance, along with the labor and equipment. The city

being unable to finance any portion of the material, the writer conferred with the local administrator of the FERA, who agreed to purchase some of the material and furnish labor for cleaning road ditches and preparing the road by hand if the funds of the property owners were sufficient to meet the requirements of the FERA and if the city would provide the equipment and any balance of material if needed.

It was found that the FERA would finance the material for the four streets up to $2,726.53, this being the balance that could be transferred from another project.

After estimating the total cost of material on the yardage basis mentioned above and deducting the amount available from FERA, it was found that if each property owner would contribute 12½ cents per front foot the work could be carried out, the cost of materials being as follows:

C.O-1 priming oil, .07 per gal., furnished and applied.
No. 4 slag, $1.20 at the plant (hauled by city trucks).
A.C.B-2 for mix and seal, .09 per gal., furnished and applied.
No. 6 slag for seal coat, $1.30 at the plant (hauled by city trucks.)

The results obtained on these eight streets were so marked in allaying the dust nuisance and providing an excellent surface, that City Council was inundated with requests to treat other streets in a similar manner and property owners expressed their willingness to contribute a portion of the necessary funds where possible.

Just at that time, July, 1935, the work program of the FERA was terminated in this district and all projects under construction were taken over by the WPA. The writer, on behalf of the city of Warren, submitted 12 projects covering the bituminous re-tread of 43 miles of ashed streets. This mileage was allowed for in order to give property owners and tenants an equal opportunity of having their street improved, recognizing that only a comparatively small percentage of the streets would be improved, owing to the inability of many owners to contribute funds. However, in many cases, where property owners were unable to participate, it was found that many of the owners contributed sufficient to make up the difference.

The twelve projects were set up as follows:

The city was divided into zones in such a manner that the estimated total federal cost of improving all the ashed streets in each zone would amount to $25,000 or less, this being the requirement of the WPA at that time. After outlining these zones they numbered twelve, each of which was set up as a project based as follows:

1. All labor and necessary gang foremen required for excavating new side ditches, or deepening and cleaning existing ditches, and labor required in road preparation was paid from federal funds.
2. All No. 4 and No. 6 slag was paid for from federal funds and hauled to the various streets by trucks paid from federal funds.
3. All spreading, blading and rolling was carried out by city equipment and city operators paid by the city from the gasoline tax fund.
4. All priming oil and asphaltic cut back for mix and seal coat and application by pressure distributors was paid for from the funds contributed by property owners, the city of Warren awarding the furnishing and applying to the lowest of invited contractors, advertising not being compulsory.
5. All new lumber sluice boxes at driveways, where required, were paid for from the property owners' contributions.

In preparing the above projects a slight change was made in the unit quantities of material, the No. 4 slag being increased to 158 lbs. per sq. yd. and the asphaltic cut back for base mix was increased to 1.33 gals., while other quantities remained as mentioned above.

In order to arrive at the material cost (federal and sponsor), half the width of the re-tread (8 ft.) was taken for a length of 50 feet, a total of 44.44 sq. yds., which resulted in the following quantities and costs based on the amounts mentioned above:

3.51	tons No. 4 slag	@ $1.20	$4.21	Federal
.44	tons No. 6 slag	@ 1.30	.57	Federal
17.8	gals. C. O-1 primer ...	@ .07	1.25	Property
59	gals. A.C.B-2 for mix...	@ .09	5.31	Property
13.3	gals. A.C.B-2 for seal ..	@ .09	1.20	Property
Allowance for share of driveway sluices			1.25	Property

The above shows a cost of $4.78 for federal material while the cost to the property owner is $9.01.

As the city assumed no cost for material used at street intersections, an estimate was made and the cost of the material necessary was pro-rated over each 50-ft. length of street on each side which amounted to 85 cents, thus bringing the property cost to $9.86 or .1972 per lineal ft. on each side of the street.

After the projects were approved in the late fall of 1935 all interested property owners were invited to a meeting and informed of the amount necessary to be subscribed on each street in order to make the improvement. It was suggested that the property owners on each individual street form a committee of three or more who would undertake the canvass of owners and collect the necessary funds on a basis of 20 cents per lineal ft. of street on each side.

As soon as the necessary funds were subscribed they were deposited in escrow at a local bank and certified to the City Auditor. When the contractor is paid for furnishing and applying the material a check is signed jointly by the City Auditor and a property owner designated by the committee. After bills are paid for the property owners' share of the work any balance at the bank is withdrawn by the depositor and returned to the various subscribers pro rata. An accurate cost is kept of the lumber used in driveway sluice boxes and the city is reimbursed from the same fund for the actual cost of the material used, the labor being included in federal funds.

The average total cost of this work (federal, city and property owner) amounts to 75 cents per sq. yd. while the cost to the property owner is 22.5 cents per sq. yd.

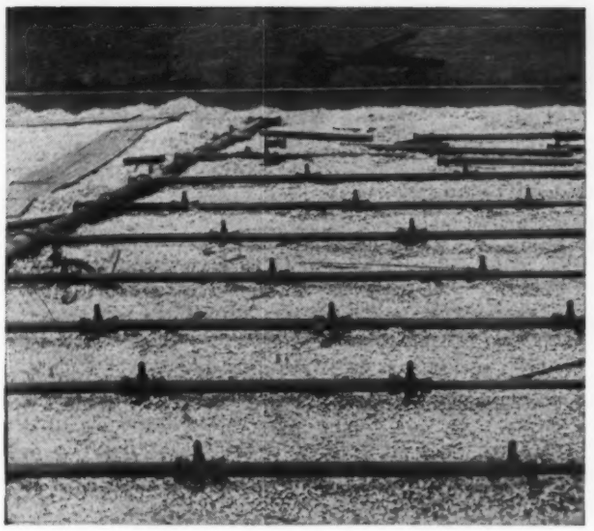
This work of re-treading was commenced on July 15th of this year and up to the present time eleven streets totalling 2½ miles have been completed, with others under construction or subscribed for.

Tar Concrete Binder for Macadam Surface

The ordinary surface treatment of waterbound macadam is inexpensive, but the durability of the surfacings so obtained is limited by the high void content. The use of fine tar concrete effectively fills the surface voids, and produces a dense and waterproof surfacing, the cost of which is about half that of an "Einstreudecke," and two-thirds that of new macadam with ordinary surface dressing. The following method is recommended for use on country roads. The existing surface is cleaned, and cold asphalt or cold tar is applied at the respective rates of 1½ lb. or 1 lb./sq. yd. to any areas where patching is necessary. Coarse tar concrete is then spread at the rate of 36 lb./sq. yd. and then rolled with a 3 to 7-ton roller. Cold asphalt or tar is then applied at the same rate as before, and fine tar concrete is spread at the rate of 30 lb. /sq. yd. and rolled. The aggregate should consist of 40 per cent 0.08 to 0.2-in. stone and 60 per cent 0.08 in. to dust.—*Road Abstracts.* B. RENFERT: *Verkehrstechnik,* 1936, 17 (5), 133-6.

The Operation of Trickling Filters

By W. W. TOWNE
Director, Division of Sanitary Engineering, South Dakota State Board of Health



Winchester, Indiana, sprinkling filter under construction.

SEWAGE treatment involves the removal of organic material from the liquid. Such material may be present in the form of suspended, colloidal, or dissolved solids. An efficient sedimentation basin will remove from 40 to 60 per cent of the total suspended matter in the sewage. All of the dissolved organic material and the remaining suspended matter must be further treated.

A trickling filter is one type of treatment used to accomplish this purpose. The process involved is one of oxidation with the aid of bacterial action. The stone particles provide a large surface for the bacteria to grow upon and a means of distributing the sewage over this bacterial growth.

Experience has indicated that filters should be from 6 to 9 feet in depth to accomplish the desired purification. The bacteria living on the filter stone require atmospheric oxygen for their existence. The placing of stone on an underdrainage system assists in providing ventilation, thereby maintaining conditions favorable for this bacterial growth.

Some of the more common difficulties encountered in filter operation may be summarized as follows:

1. Filter ponding or "pooling" due to either, (a) too fine material or, (b) an excessive growth of bacterial slime on the rock.

2. The clogging of spray nozzles or orifices due to, (a) floatable material such as match sticks, etc., which has not been removed in the sedimentation basin or, (b) an accumulation of grease which gradually clogs the nozzle.

3. The growth of large numbers of filter flies.

4. The clogging of underdrains due to the accumulation of material which has sloughed from the filter.

5. The clogging of the distribution piping for the spray nozzles.

6. The escape of odors as the sewage is sprayed onto the filter.

7. Air leaks that permit the escape of air resulting in continuous dosing of only a small portion of the filter.

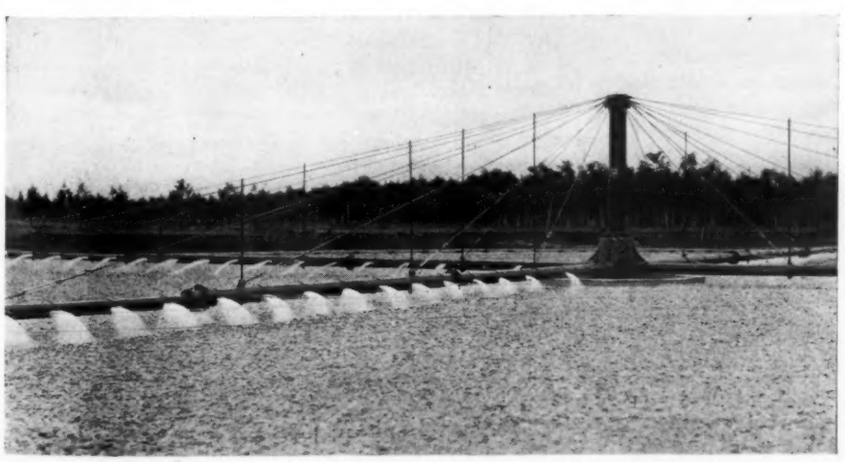
The control of these difficulties may be accomplished by one or more of the following procedures.

Ponding or Pooling

The control of ponding of trickling filters, if due to excessive bacterial growth, may be remedied by: (1) flushing the surface of the filter with a fire hose, (2) raking or forking the top layer of the filter media, (3) applying heavy applications of chlorine or chlorinated lime solution directly onto the surface of the filter or in the filter influent at the dosing tank, (4) cutting the beds out of operation for a period of 36 to 60 hours, or by flooding the bed for a similar period.

For small beds, raking or forking is often the most satisfactory remedy. It will usually be found that the excessive growth of bacterial slime is prevalent in the top portion of the filter only. Raking the filter rock breaks up this slime.

Ponding is seldom caused by too fine material except where an excessive amount of fines may have accumulated, as where the material has been dumped from trucks. In such instances, remove all rock from this portion of the bed and rescreen through a 1″ screen.



Dorr Revolving Distributor at Escanaba, Mich., on a bed 150 ft. in diameter.

Spray Nozzles

All clogged spray nozzles, or orifices in revolving distributors, should be cleaned as soon as clogging is noticed. If this clogging is due to match sticks, etc., a fine screen placed at the dis-

charge of the sedimentation tank will assist greatly. If it is due to grease, grease removal ahead of the sedimentation tank is the logical solution to the problem.

Filter Flies

The common filter fly *(Psychoda)* often causes considerable trouble. Especially is this true if the sewage treatment plant is in close promixity to residential properties. These flies lay their eggs in the filter and the incubation period varies with the temperature. The minimum incubation period has been determined as being approximately 9 days.

The best method of controlling the fly is by flooding the filter for a period of 24 hours at 9 days intervals. This process destroys the fly larve and has been used quite satisfactorily at many plants.

Underdrains and Piping

At each end of the underdrainage system there should be an inspection gallery, or if this is not possible each underdrain should be carried to the surface at the upper end of the line with an inspection gallery at the lower end. If clogging is indicated by a reduced flow from any of the drains, this may be remedied by flushing with a fire stream from the upper end, by rodding with sewer rods, or a combination of both.

Each line of distribution piping should be provided with a valve or easily removed plug in order that the line may be flushed out by removing the plug or opening the valve when the filter is dosing. If these provisions are not available, much can be accomplished by removing the spray nozzle on the end of each line of pipe during one or more dosing periods.

Odors, Their Causes and Prevention

Sewage odors are usually caused by the escape of gases into the air as the sewage is sprayed onto the filters. This may be due to a septic sewage as it enters the filter or to certain gases produced in that particular sewage.

Control of odors has been accomplished quite satisfactorily by continuous chlorination of the filter influent. If these odors are serious, it is advisable to consult the Engineering Division of the State Board of Health for a thorough study of the cause and remedy.

Dosing Tanks and Siphons

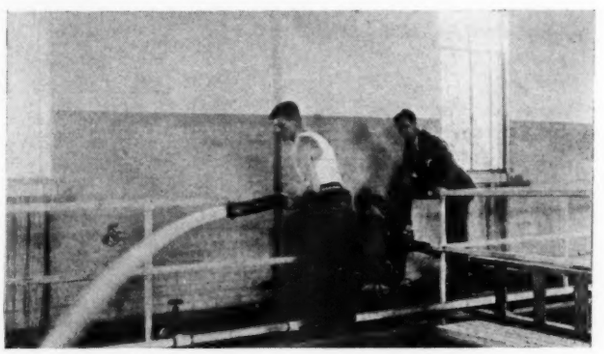
When a dosing tank fails to fill, resulting in a continuous flow through the siphon, there is indication of an air leak or clogged piping. Air leaks in dosing siphons are difficult to find and where such a condition is indicated it is probably best to replace all of the air piping with new material and do the work in such a manner as to insure against the possibility of an air leak at any joint. Care should be exercised that the new pipes are exactly the same lengths as were the old ones. In large systems, and where twin dosing tanks and siphons are used, with a considerable amount of intricate air piping, complete replacement may be quite expensive. In some dosing tank installations the cost of material is a small item and better results may be expected by complete replacement.

The clogging of blow-off traps with grease and other solids may also cause the siphon to function improperly. In these instances a cleaning of all the small air and water pipes may solve the problem. Grease and other solids accumulate in dosing tanks, especially around the high water line. Chunks of grease are constantly being dislodged and passed through the siphon into the spray system, thereby clogging nozzles and orifices. Removal of this grease at regular intervals will do much toward lessening the work in cleaning of nozzles and orifices.

Using Settled Sewage To Wash Down Sludge

An interesting experience is reported in connection with the washing down of sludge accumulating at the surface of the gas vents of the Imhoff tank owned by the village of Lawrence, Long Island.

The city water, at about 90 lbs. pressure, had been used to break down the caked solids on the surface of the gas vents, and the monthly bill from the Water Department to the Sewage Department was about $14. Frank Klinck, the operator, conceived the idea that it was not only wasteful to use fresh city water in this manner, but was increasing the load on the plant without any justification, and that if he could use the settled sewage flowing through the tank in connection with the proper pump, he could break up this scum more



Washing down sludge at Lawrence.

rapidly than he was doing it with the city water, and could save the $14 monthly water bill.

He arranged to try a 3″ Marlow self-priming centrifugal pump powered with a single cylinder, air-cooled, gasoline engine, and the photograph herewith shows the pump in service. An old piece of 3″ hose was used on the discharge side of the pump, and the unit met Mr. Klinck's expectation in every way. The sludge was effectively broken and washed down in much less time than had been required previously.

Cheese and Cannery Waste Treatment

A cheese plant waste treatment works which employs the Halvorsen Smith Process has been constructed at Summitville, Ind., and is being operated under the supervision of H. A. Trebler, Chemical Engineer, National Dairy Products Corporation. The plant is equipped with fine screens, a holding tank, a forced draft trickling filter which operates at a rate of from 20 to 30 million gallons per acre per day, and a final settling tank. Provisions for sludge disposal have not been developed at this time, but this item will receive attention as soon as preliminary operating problems have been solved.

An experimental waste treatment plant is being constructed at the Greenwood, Ind., factory of Stokely Brothers, Incorporated, under the supervision of the Bureau of Engineering. This project was made possible by the cooperation of the members of the Indiana Canners Association, who have raised the necessary funds by private subscription.

The plant is designed to treat a flow of at least 20 gallons per minute. It will be operated throughout this canning season on green beans, corn and tomato waste. Results will be available to the Canners Association for reference and guidance in the development of plant scale treatment units.

An annual saving of over $5,000 and the conservation of 147,310,000 gallons of water per year by the Water Department.

By ARTHUR M. FIELD
City Manager of Winchester, Virginia

Monthly pumpage for the year before and following the survey

Distribution System Survey Profitable for Winchester

IN January, 1935, the writer was appointed City Manager of Winchester, Virginia, and one of the first necessities confronting him was an analysis of the water supply.

Until fifteen years ago Winchester drew its supply from one spring. Since then the average daily consumption has increased from 660,000 to 1,660,000 gallons per day and two springs have been added to the supply. Water from the springs is pumped through the distribution system to two reservoirs above the city, with capacities of 3,000,000 and 500,000 gallons, respectively.

The nature of the subsoil about Winchester is limestone rock and clay, and as a result the capacity of the springs is limited. The flow of the springs is lowest generally a year following a drought, owing to the underground limestone reservoirs (characteristic of this country) being drawn down and not replenished.

As the combined flow of the three present springs was 1,750,000 gallons per day in 1931, a year after the last drought, and the consumption in 1934 frequently ran up to 2,250,000 gallons per day and averaged 1,700,000 gallons per day, it is apparent that conservation of water assumed great importance.

The total pumpage in 1933 and again in 1934 was approximately 615 million gallons, or (with a population of 12,000) 140.6 gallons per capita per day, which indicated leakage.

For the year 1934, 222 million gallons were metered to others, leaving 393 million gallons for domestic users and leakage, or an average of 90 gallons per capita per day. The principal local industries use large amounts of water in proportion to the population and they have expanded abnormally during the past fifteen years.

All industries, commercial and free users and about 88% of the domestic users were metered. (A program of 100% metering has been completed this year.) A check on the domestic consumers that were metered showed an actual average metered usage of 30 gallons per capita per day, indicating again that there was leakage. A careful survey and follow-up inspection showed that there were no leaks of consequence on unmetered services.

The total consumption for the year ending December 31, 1934 (before the survey) was 1,690,000 gallons per day and was distributed as follows:

	G.P.D.	Percent
Metered Consumption	890,000	52.7
Under-registration Industrial Meters	55,000	3.3
Underground Leakage	389,000	23.0
Estimated House Waste	30,000	2.0
Estimated Public Use	40,000	2.2
Total Accounted for	1,404,000	83.2
Unavoidable Leakage at 3,000 gallons per day per mile of main	90,000	5.3
Unmetered Use and Waste	196,000	11.5
Total Consumption	1,690,000	100.0%

To check further on our suspicions, we measured the amount of water entering the mains at 2 o'clock in the morning, when supposedly most of our normal use was at a minimum. To measure the flow, the pumping stations were shut down and the large reservoir cut off, and the drop measured in the small reservoir which was supplying all the water for the mains. In 30 minutes, from 2 A. M. to 2:30 A. M. on January 5th, 1935, the level dropped 10", which was equivalent to a rate of 846,000 gallons per day or 70 gallons per capita per day.

These data, which proved conclusively that something was wrong, were presented to Council and as a result S. Lee Grant, superintendent of water and sewers, was authorized to enter into a contract with the Pitometer Company to make a survey of the system and to install permanent equipment and train the Water Department in the use of Pitometer equipment so that we could periodically check the system for leakage ourselves.

It is unnecessary to go into the details of the survey method, which was that ordinarily employed by the Pitometer Company. It is sufficient to say that the city was divided into districts and the hourly flow into each district measured over a period of 24 hours. The percentage of night rate to total rate varied from 37% to 82%. In the districts with a high percentage, unless night usage could be proved, trouble was indicated and a detailed search made for undetected leaks.

The results of the survey were outstanding and included:

1. The detection and repair of

25	main leaks wasting	168,000 gallons per day
61	service leaks wasting	217,000 gallons per day
2	misc. leaks wasting	4,000 gallons per day
88	total leaks wasting	389,000 gallons per day

The leaks as found were immediately repaired; in case of leaks on old iron services, these were replaced with new copper services.

At a conservative estimated cost of production of two cents per thousand gallons the leakage stopped saved $2,839.70 per year.

2. Under-registration of industrial meters corrected resulted in an increased revenue of $1,260 per year.

3. The meter of one large user in the county (paying double rate) was found to be using in three months 1,000,000 more gallons than billed for quarterly. (The meter was turning over completely between readings.)

4. Two cases of unauthorized use of fire by-passes were discovered.

5. Pump efficiency tests and the recommendation for an in-between size pump will result in a saving of approximately $1,200 per year in power bills.

6. The replacing of several mains with pipes of larger size, which was recommended, will reduce the pumping head at the springs.

The total savings as a result of the survey will reach $5,300 per year, while the cost of the survey was less than $2,500.

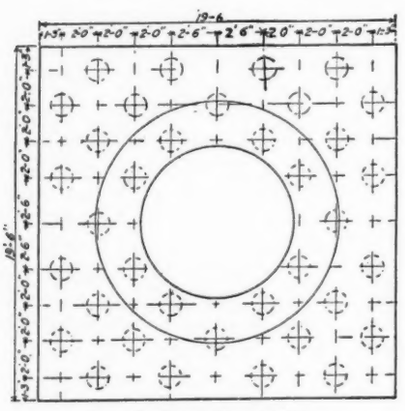
The chart attached indicates the monthly pumpage for the year before and the year following the survey.

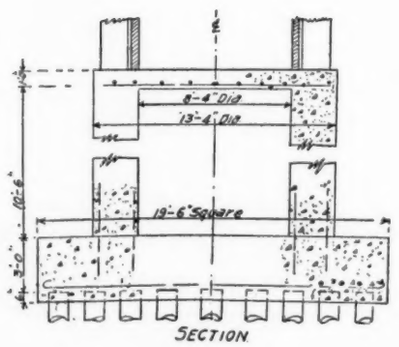
During the year from March, 1935, to February, 1936, water revenues, due to an increase in meter readings of 63,310,000 gallons, were about $5,000 more than for the previous twelve months, and during this same year the total pumpage was 84,000,000 gallons less. The survey and checking of leaks was not completed till about March 15th, 1935.

Creosoted Timber Piles Support Stack

THE heating and power plant of the University Project, one of the low cost housing developments in Atlanta, Ga., was located in an area where pile foundations are required for heavy concentrated loads. The 175-ft. stack was so heavy that it was found necessary to place it on a pile supported base. The work was described in Wood Preserving News, as follows:

A test wooden pile was driven at the site to determine the requirements, both as to load capacity and length of the foundation piles. The test pile was driven with a very light double - acting steam hammer to practical refusal at a point approximately 20 ft. below the stack footing. To eliminate any doubt as to soil conditions existing below the point of the test pile, and to determine whether or not deeper penetration of the bearing piles was necessary, a series of "jet tests" or wash borings was made.





Pile layout under chimney foundation

These borings disclosed that the test pile had encountered a thin gravel stratum unable to be passed by the light hammer and that this was underlaid with 20 ft. or more of soft silt resting on a thick gravel bed over clay and hard pan extending to rock. All indications pointed to the likelihood that under a more adequate hammer piles could be put down into the lower gravel stratum, or even into the firm clay underneath.

This procedure required piles about 45 ft. in length, and to drive them a hammer delivering 15,000 ft. lbs. of energy, minimum, was specified. With this requirement put into execution, no difficulty was encountered in driving the piles to the specified penetration, the contractor being required to continue driving into the hard stratum until a bearing value of at least 20 tons per pile should be reached.

The stack foundation or footing consists of a concrete slab 19 ft. 6 in. square and 3 ft. 6 in. thick, under which 36 creosoted timber piles are spotted in one symmetrical group at a minimum spacing of about 2 ft. 10 in. center to center of piles. The arrangement of the piles with respect to the center of the stack is such that the load falling to each single pile is as nearly uniform as possible.

The piles were specified to be southern yellow pine to meet Class A requirements of the American Society for Testing Materials as to size and physical characteristics. Thus, the piles have minimum 14-in. butts, and a preservative treatment of 15 lbs. Grade One creosote per cubic foot of wood was called for. Preservative treatment is necessary because the piles are cut off well above the level of ground water.

The work of driving the piles was done by the Raymond Concrete Pile Company, using a single-acting steam hammer of 5,000-lb. ram, delivering approximately 15,000 ft. lbs. energy. Before capping with the concrete footing the pile cut-offs were thoroughly field treated with hot creosote, and roofed with a coat of pitch.

A. O. Clas is director of housing for the administration. The foundation design was made under the direction of A. M. Korsmo, engineer of plans and specifications section, of which J. A. Cramer is chief. Architects for the project are Edwards and Sayward of Atlanta, Georgia.

The Editor's Page

Changing Trends in Snow Removal Equipment

The heavy snowfalls of the past few winters have brought a realization of the need for heavier snow removal equipment to supplement the light, fast plows used to such a considerable extent during the years of the early 30's. No one, of course, knows how long this cycle of heavy snowfall will continue; but as long as it does, the state or county that does not have an adequate amount of the heavier equipment is going to be handicapped.

Most states, counties and cities in the snow belt skimped on equipment for snow removal during the lean years, and now need plenty of new equipment. In buying it—which they should take steps to do before the heavy snowfalls come—they would do well to provide for equipment to meet the needs that have developed during the past two or three winters. Not only have there been heavy snowfalls, but these have been followed with rains or thaws which form a heavy crust. This is fine for the ski and snowshoe enthusiasts, but hard on the snow removal men.

Heavy equipment does not necessarily mean rotary plows, though one or more of these are most handy tools (one north-west State owns twelve of them); it means big, heavy trucks and sturdy tractors, both of them equipped with plows that ask favors from no snowdrift.

Purchasing new equipment also gives opportunity for obtaining the latest improvements. Most of the manufacturers have developed a number of such improvements recently. These may include changes in shape of blade to roll the snow back, or to throw it some distance to the side; complete hydraulic control for both lifting the blade and forcing it down; adjustable wings for trimming off banks; ice scarifiers; improved sidewalk plows; and a variety of construction details, including strengthening of parts that experience has shown to need it.

Highway Planning Surveys

In cooperation with the United States Bureau of Public Roads, the various state highway departments are beginning a planning survey of their road systems. The data collected will be grouped under three general heads: A road inventory, a traffic survey, and financial studies.

There has been a real need for securing such data for many years. It may seem strange that 3 billion dollars a year was spent for many years without the basic knowledge that these planning surveys will give; it is even stranger that so very little of this tremendous sum was wasted. Few of our roads today are overbuilt.

The road inventory will give data on the location, type and condition of all roads, ferries, railroads, wharves, schools, rural industries and farm buildings. From the information thus obtained, maps will be prepared covering each county and showing basic data thereon.

The traffic survey is aimed to determine what the facilities shown by the road inventory have to carry. Information will include traffic studies covering all types of traffic, its density, the weight of trucks, buses, etc. With these data at hand, a rational plan can be devised for construction of needed roads; and the type or class of a highway can be determined from the weight and amount of traffic that it will have to carry.

The third phase of the study will relate to the financial phases of highway work, and will assemble and analyze data regarding highway revenues and their uses. Such studies will cover states, counties and cities. When coordinated with the knowledge gained from the other two phases of the work, this information should permit the formulation of an adequate local, state and national highway program, suited to modern traffic conditions, and financially sound.

Keeping Sewage Fresh

One of the most noticeable features of the recent change in sewage treatment practice is illustrated by the Highland, Ill., plant as described in "Sewage Works Journal" by W. Homer Wisely. Here the primary sedimentation tanks have a retention of only 1.25 hours, "because of the need to keep the settled sewage fresh." Moreover, part of the plant effluent is returned to either the raw or the settled sewage, resulting in "a marked freshening of the sewage," and the dosing tank is aerated with compressed air to "arrest possible souring of the settled sewage." (These precautions were due largely to the fact that 55% of the sewage consisted of milk and brewery wastes, and that these caused the sprinkling filter to be somewhat overloaded, and the dosing tank was very large.)

A decade or two ago the septic tank was the principal feature of practically all plants, and the staler the sewage reaching it the more quickly it operated. Septic treatment was not too favorable to the succeeding treatment by sprinkling filters, and dosing these with fresh rather than septic effluent should permit obtaining better results with them at much higher rates. (Recent experiments by a number of investigators indicate possibilities of rates five to ten times as great as the old standard of 300,000 gallons per acre-foot.)

Here as elsewhere prevention is better and cheaper than cure. Keeping sewage fresh is generally preferable to freshening stale sewage; it not only facilitates almost all kinds of treatment now in vogue but it prevents odors, deterioration of metal and concrete in sewers and plant by sulphuretted hydrogen, and offers other advantages.

But receiving fresh sewage at the plant requires freedom from deposits in the sewers and appurtenances, and comparatively short distances from extreme ends of the system to the plant. And these in turn require designing with sufficient grades and correct manhole bottoms and other appurtenances, and careful construction; also a number of small plants centrally located rather than one large one distantly removed from the city. (The last is made practicable by modern odorless treatment of fresh sewage.)

From which it follows that the entire sewer system should be designed with reference to the treatment plant, and also should be so operated as to prevent deposits at any point.

Trucks and Tractors Important in Snow Removal

City, County and State Engineers Give Views on Most Economical Snow Removal Equipment

THE following equipment is used in Springfield, Mass., for snow plowing, snow removal, and ice control systems, according to a report from Cornelius W. Phillips, Supt. of Streets and Engineering: 56 blade type snow plows, 5 "V" type of "A' snow plows, 1 heavy duty "V" type plow, 4 tractors equipped with rotary brooms for sidewalk clearance, 1 four-wheel-drive truck equipped with a Sargent "A" plow with side wings for cutting down drifts, 10 Barber-Greene snow loaders with belt conveyors having a digging width of 6 feet, and 7 spreading machines. "Having experimented with equipment for a period of 16 years, we find the above listed equipment most adapted to our purpose from the viewpoint of economy and effectiveness."

For snow and ice removal in Jamestown, N. Y., L. L. Graham, Director of Public Works, reports the use of the following city equipment: Two blade plows attached to two city flushing trucks, one V plow on truck, a one-man Warco grader and a small blade on small tractor for intersection work. "Our city trucks have the snow from the down-town streets and we hire two or three large trucks if we have an exceptionally heavy fall of snow."

Plowing is done in Hartford, Conn., with 25 city-owned plows mostly on rented trucks, reports Leon F. Peck, Supt. of Streets. "Snow removal is by four mechanical snow loaders and by hand shovelling with rented trucks."

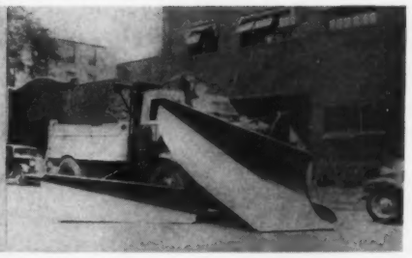
DuPage County, Ill., has eleven large tractors and snow plows and a number of trucks equipped with plows to take care of the removal of snow, says Eugene F. Gates, Supt. of Highways. "We find the trucks very efficient for light snows; when we have heavy drifts the tractors get rid of it quickly and efficiently. When we see a storm coming we prepare for work, outlining the district each man is to cover and have men on duty day and night, with someone in the office to take care of phone calls, until the roads are clear."

Top—Smallest and largest V-type Frink plows; former hand hydraulic control, latter with wing full power hydraulic control. Bottom—Allis-Chalmers Model K with Wausau plow on Wisconsin road.

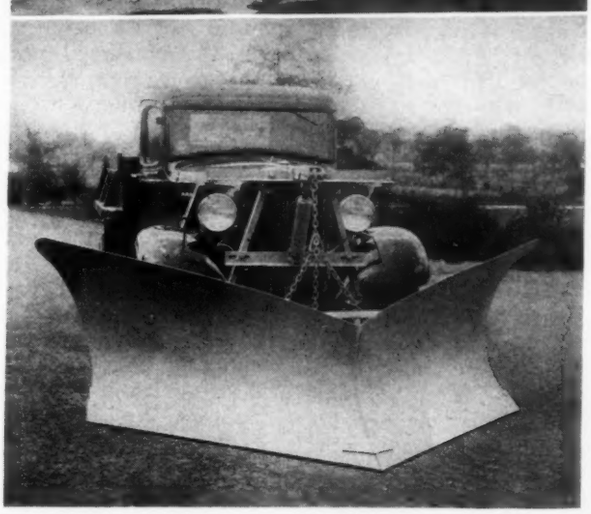
Austin Western plows on Dodge 2-ton trucks. Above—V-type plow. Below—One-way tapered blade.

The most of the equipment in Summit Co., O., is blade plows mounted on 2½ and 3½-ton trucks and the speed plows mounted on 1½ and 2-ton trucks, states Hal G. Sours, county engineer. The speed plow is very efficient if it can be used before the snow becomes too deep and also in keeping roads cleared after the heavy snow has been plowed out of the way. This is principally due to the fact that they are much faster than the ordinary blade plow. "We do not own any rotary equipment, although the state highway department has an outfit in this county. While we have a considerable amount of snow in this section, by keeping continually after it we are able to keep the roads open without the use of the rotary plow. It is only occasionally that the snow becomes deep enough that the blade plows will not handle it. The drifting, generally speaking, is taken care of by the use of snow fence which is placed in the fall before the winter season begins. We quite often use motor graders, especially for the purpose of widening out the cuts that the snow plows have made and pushing the snow back onto and off the shoulders into the ditches."

"Our policy is to hire all the equipment we can but it has been necessary to purchase where it could not be hired," writes H. E. Sargent, Commissioner of Highways of Vermont. "We have some 70 miles of snow fence used on the State Highway System. The average snow fall last year was 85.6 in. The following equip-



Top row: Left—Western one-way tapered blade plow in Stratford, Conn. Center—Austin Western 77 Jr. motor grader with V-type plow, in Mankato Twp., Minnesota. Right—Latest model Frink full power hydraulically controlled "Sno Plow" and front-mounted leveling wing, on Walter truck.



Center row: Top—International Harvester I-12 industrial tractor cleaning sidewalk in Illinois. Bottom — Good Roads Model 20 E V-type plow, hydraulic lift, for 1-½ ton truck.

At right — Caterpillar RD8 tractor and 12-yd. Le Tourneau "carry-all" straddling drifts and scooping up ice and snow which it carries to and dumps in vacant lots.

Below — Good Roads plows. Left —Reversible blade, hydraulic-lift, flare plate, safety-blade trip, for 1½-ton truck. Right — Model 220 tapered blade adjustable plow.

ment was used: 93 light trucks, 50 heavy trucks, 12 tractors. Of this equipment 51 plows, 18 trucks, and two tractors were State owned."

During the winter of 1934-35, Oregon, R. H. Baldoch, State Highway Engineer, had in use (or standing by, ready for use on short notice) 168 displacement plows and 17 rotaries. "We are now purchasing 20 additional displacement plows. In addition, we have 57 motor graders that can be used in an emergency such as the quick removal of a moderate fall of snow over a wide area."

"The equipment that we use is our large trucks that are used during the summer time for our regular maintenance work and also small 1½-ton trucks that we hire from our summer maintenance patrolmen. We only use them during the emergency periods. We do not intend to buy any new equipment until such time as the Legislature appropriates funds and makes it incumbent upon us to indulge in snow removal." David Noonan, Assistant Commissioner, Division of Highways, N. Y.

"For the winter 1934-35, 1456.421 miles received winter maintenance on our primary system at a cost of $215.84 per mile. On our secondary system 875.241 miles were plowed and sanded at a cost of $157.36 per mile," says F. E. Everett, Commissioner, New Hampshire Highway Dept. "The equipment used in connection with this work consisted of: 74 1½-ton trucks, 77 2 to 3-ton trucks, 23 3½ to 5-ton trucks, 1 7-ton Walter, 1 9-ton F.W.D., and 3 tractors for emergency use. These trucks are equipped with blade and V-plows and wings. One rotary plow is interchangeable with a blade plow on the 9-ton F.W.D. We prefer speed-type blade plows with right hand wings for ordinary snow removal, with interchangeable V-type plows for use in drifted areas and in widening."

The equipment used in Ohio, Carl G. Wahl, Assistant Director of Highways, consists of 485 snow plows, 250 of which are light speed plows and 235 are plows for heavier trucks. "In addition to this we have 6 rotary plows and 8 tractor plows. These 485 conventional type snow plows are mounted on our regular maintenance trucks. We do not have to rent trucks for this purpose. In addition to this equipment we have 184 spreaders which are used for spreading cinders or other abrasives on our icy pavements. The type of equipment that we have found most suitable for snow removal in this state is the light truck plow that can be mounted on 1½-ton trucks and can travel while working, clearing snow at a speed of from 20 to 35 miles per hour. It has been found that use of light, speedy trucks, which get out and start working when the snow starts and keep up with the snow, are much more efficient than the heavier type snow plow which travels at a much slower speed. The trend is so definitely in this direction that the heavier plows are being used only when through some mischance a snow gets ahead of the maintenance forces and drifts or piles up to a considerable depth."

"During a winter of heavy snowfall," reports T. H. Dennis, Maintenance Engineer, California Division of Highways, "it is expected that snow removal work will be required on some 3,300 miles of state highways. The 1933-34 winter was very mild in California, and work was necessary on only about 2,000 miles of these roads. The equipment available in a normal season is as follows: trucks, 107; "30" tractors, 26; "60" tractors, 3; motor grader "V" push plows, 22; push plows, "V" type, 44, and straight blade, 73; truck rotaries, 19, and tractor rotaries, 3. Equipment is transferable, and not only is regular maintenance equipment available, but units are rented from counties and other agencies when necessary."

Snow Removal Equipment and Methods in Nobles County, Minn.

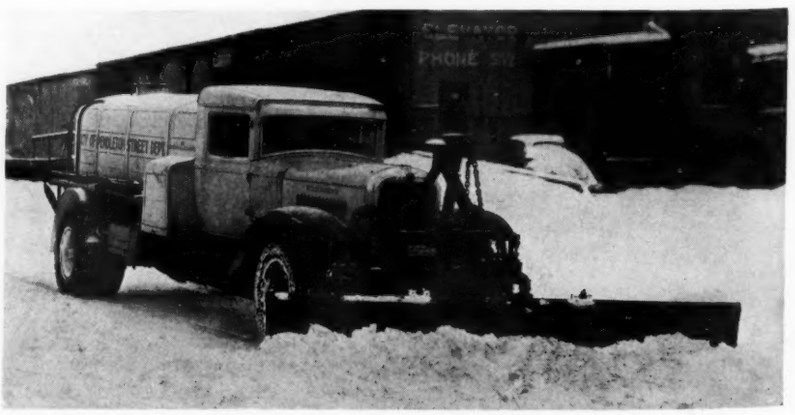
By Henry R. Bray, County Highway Engineer

Nobles County is in southwestern Minnesota in a region of heavy snows and in open country where the snow drifts with every wind. The county highway system comprises 246 miles of county primary roads and 152 miles of county secondary roads, all of which are kept open to winter traffic.

Our snow removing operations, from start to finish, are based almost entirely upon the elimination of drift catching banks along the shoulders and in the ditches. We pull the snow into the roadway instead of pushing it off and for that reason so-called displacement plows are not used. Our snow removing equipment consists of six motor graders and two Snogo rotary snow removers. Motor graders are equipped with V plows in front and special snow mouldboards. In our method of operation, the V plow serves only to clear a path for the front wheels; the snow moving is done with the mouldboard. The Snogo rotaries are of the auger and fan type, each unit complete in itself. The motor graders start work immediately after each snowstorm, pulling the snow to one side of the roadway or from both sides into the middle; opening the road to traffic and piling the snow into a windrow on the roadway where it can be reached by the rotaries. The Snogos follow, picking up the snow in the windrow and blowing it out into the fields, clearing the entire roadway and leaving no banks to catch future drifting snow. All units are equipped with lights and work continuously until all roads have been cleared.

Because we religiously avoid the formation of drift building banks along our roads, our snow removing problem is not greatly aggravated as the winter goes on. When spring comes our ditches are not piled up with packed snow and ice; they are in good condition to carry away the spring run-off water. All our country roads are gravel surfaced and it is remarkable what a small amount of spring break-up trouble we have had since we started handling our snow removing in this manner eight years ago. We know that this saving of gravel surfacing on our roads during spring break-up more than pays the cost of our snow removing work, say nothing about the convenience of open winter roads.

Three-ton reversible Austin-Western plow mounted on GMC truck, cleaning streets in Pendleton, Ore.



At the right is shown one of the 12-yard hydraulic control scrapers handling the dirt for the dam. It has been moving 90 yards an hour. Below is shown a plan of the dam, with the cutoff walls, spillway and outlet pipes. A section of the dam is shown, illustrating the construction of the clay puddle core; and a detail of the crest is also shown.

Design and Construction of a Small Earth Dam for Water Supply

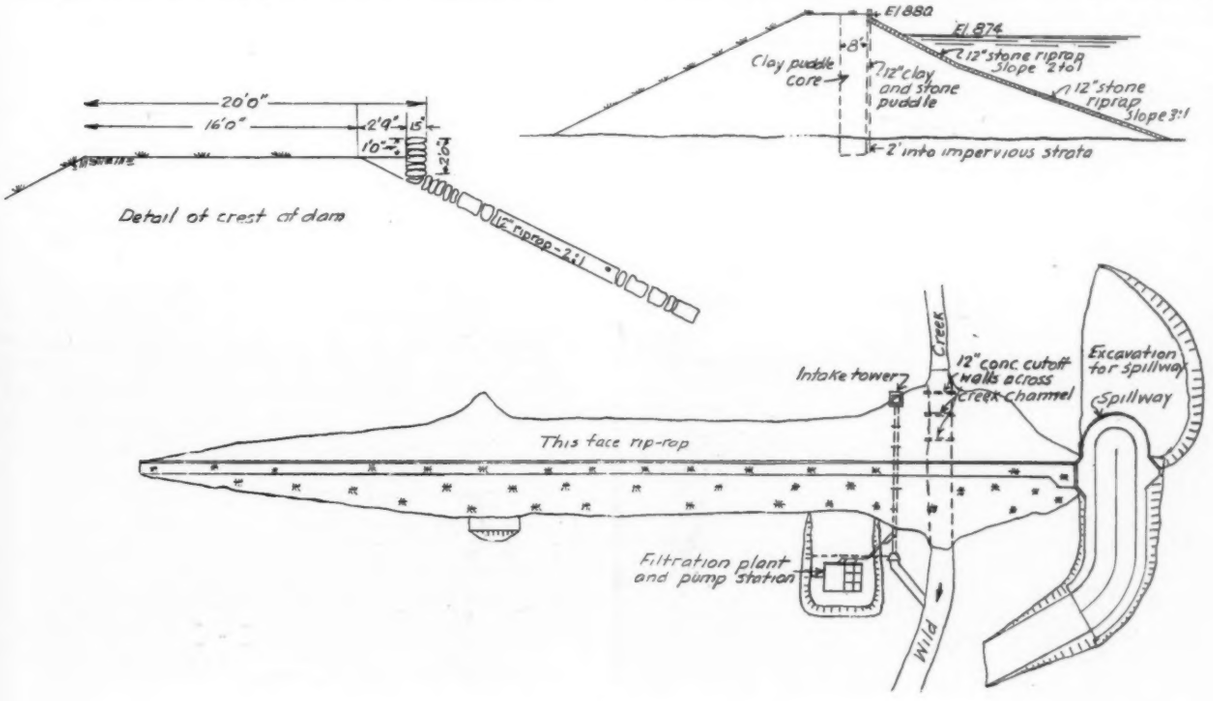
IN the early days the Los Angeles settlers digging for water struck oil and were disgusted. In Oklahoma, on the Osage reservation, oil companies dug for oil, and having found it started pumping operations that ruined the drinking water of Fairfax, to the disgust of that community.

To overcome this, the V. V. Long Co. of Oklahoma City was engaged as consultants to find a new source of water. Wild Creek, about 3½ miles northwest of the town, was selected as the most practical source. The work, as planned, involved constructing a dam, filtration plant and 8-inch pipe line. The estimated cost of $111,000 was to be raised 30% through the PWA and the other 70% by means of a bond issue.

The contract for the construction of the dam was awarded to the Sherman Machine and Iron Works, Henrietta, Okla., and work on the dam was begun last March under the direction of D. T. Allen.

Design Factors of the Dam

The dam is to be 1400 feet long and have an average height of 30 feet. The downstream slope is 2:1; the upstream slope is 3:1 to within 16 feet of the top, where it changes to 2:1; the top width is 20 feet; the freeboard is 6 feet. A spillway is provided having a capacity



of 8,000 cubic feet per second; the drainage area being 8 square miles, this provides a spillway capacity of 1,000 second-feet per square mile. The spillway is protected on the floor and sides with grouted rip-rap. Water spills over a rim of reinforced concrete placed in a semicircle of 50-ft. radius. The channel from the spillway is laid on a 3% grade to the original channel below the dam.

In preparing the site, the entire area was cleared of all vegetation. The downstream half of the base was plowed 8 inches deep; the upstream area was stripped to a depth of 12 inches, all material was moved to the downstream area and the stripped base plowed 8 inches deep. Three cut-off walls were placed at equal intervals across the creek channel on the upstream section of the dam. These are 12 inches thick, of reinforced concrete, with ½-inch bars spaced 12 inches on centers both ways. They were sunk at least 3 feet into solid rock and shale that formed the bed of the stream, and extended 3 feet above the stream bed, being tied solidly into the banks on both sides.

The corewall was carried down at least 2 feet into an impervious or rock stratum; the bottom width was 9 feet, and the wall extends the entire length of the dam. This corewall was constructed of specially selected clay with at least 12 inches of the wall composed of crushed stone for 50% of the mass. The material in the core was placed in layers not exceeding 8 inches in depth and rolled with a sheepsfoot roller which exerted a weight of at least 250 pounds per linear inch.

The intake tower is placed at the upstream toe of the dam near the original creek; it is of concrete, 6 feet square inside, with walls 12 inches thick. Two inlet ports are provided 12 and 24 feet above the base. From this intake tower two lines extend through the dam to the filter plant at the downstream toe. One of these is 12-inch Class C cast iron; the other 10-inch Class B. Both of these are provided in with cleanout branches.

Construction Data

Using one Austin-Western 12-yard hydraulic control scraper, the contractors are taking the 100,000 yards of borrow required to complete this project from the future bed of the reservoir. The top soil is first stripped off with the scraper to reach the clay subsoil beneath for use on the dam. On an average haul of one hundred yards this machine, hauled by an A-C tractor, is moving better than ninety yards per working hour. The material moved handles well with this type of scraper even in wet weather.

As the material is discharged from the scraper the action of the tractor and scraper help to compact the material and stabilize the embankments. This compacting action is further aided by spreading each load to a maximum depth of eight inches. As each load is dumped it is wetted and a sheepsfoot roller makes ten passes over it. At the time of writing, 75,000 yards of material has already been placed and it is estimated that the entire job will be completed not later than the first of October.

Native limestone and sandstone are used on the upstream side of the dam to form a 12-inch riprap face. The stone for this is quarried from the sides of the hills near the dam site.

When completed, this 1400 foot dam will store up 400,000,000 gallons of water, covering 80 acres, which will be ample for the community it is designed to serve for many years to come.

As a PWA project, the work has proved satisfactory from the point of view of employment, since one hundred men have been at work on the project.

Pitts Beatty is chairman of the Town Board, the other members being L. A. Harrell and J. B. McNew. Robert F. Long is resident engineer in charge of the work.

An SOS from a North Carolina Water Works

"We wish help for solving the following problem in connection with our water system:

"The last service tap on one of our mains—a 6" c.i. line—is a 1" tap 625' from the end of the line. There is a hydrant at the end of the line, but opening this creates a water hammer in the line which has run into this service tap and through the ¾" service line into the house, bursting the water-back in the stove, and of course doing quite a bit of damage. The normal pressure on the main is 70 pounds per square inch.

"We wish to connect a fixture which will eliminate the water hammer when closing the hydrant, from the main as well as from the service. This is the only point on our system where this occurs. We have tried closing the hydrant at various speeds, but water hammer occurs at all of them." Our reply was:

We think your best remedy is to install a pressure relief valve on the 6-inch water line near the hydrant. We presume that the hydrant is on a branch or T, and that you have a plug in the end of the 6-inch line. In this case, put in a 6x4 reducer and install a 4-inch pressure relief valve. If the hydrant is directly on the end of the line, and there is no plugged end, you will have to change the layout by putting in a T or other special here.

These pressure relief valves are usually set for 10 or 15 pounds in excess of the working pressure, which would mean 80 or 85 pounds in your case, and then adjusted as may be needed from actual operation.

It would also be a help if there were a similar small pressure relief valve on the 1-inch tap, but we do not think you will need it, if a relief valve is used at the hydrant. Put the 4-inch valve in a box protected against freezing and fill around with broken stone for a seepage pit to take care of the water that is wasted.

Tax Law Enforcement Is Profitable in Mississippi

Successful enforcement of Mississippi's new gasoline tax law by the newly-created motor vehicle commission and curtailment of revenue losses resulting from a continuing legislative investigation of gasoline tax evasion have led tax officials to express the opinion that the state's revenues from this one tax source will be increased $2,000,000 to $3,000,000 in 1936.

Mississippi, one of 12 states where gasoline tax evasion has been found to be serious within the past few months, increased gasoline tax collections more than $500,000 in the first two months of the new law. Collections from back taxes already exceed $20,000, some 125 indictments for gasoline tax evasion are expected in the near future, and plans are being made to file suits for more than $100,000 in gasoline taxes still believed to be due.

Governor White recently announced that, as a result of the prevention of tax evasion and the increase in collections, the state will be able to pay for its highway improvement program 12 years earlier. He said that gasoline tax revenues for May, 1936, were more than $214,000 greater than for May, 1935, and that refunds for June were estimated at only $20,000, as compared with $82,876 for June last year.

Gadsden's New Cast Iron Outfall Sewer

By TROY WATFORD

City Engineer, Gadsden, Ala.

J. Herbert Meighan, Commissioner of Public Works of Gadsden, who was in charge of the work described

WHEN the city of Gadsden, Ala., with 24,000 population, annexed in 1932, the adjoining industrial town of Alabama City, which had 8,500 population, it annexed also the necessity for sewer construction in a big way. Not only were many miles of laterals needed, but mains, outfalls and connections also.

Immediately after annexation took place, the enlarged municipality of Gadsden, in cooperation with the Civil Works Administration, began the work of reconstructing and enlarging the sewers. The first job was the laying of some 17 miles of additional lines of all types —laterals, mains, and outfalls. The main discharge line was a 15-inch vitrified clay line which, with the new increments of flow, became seriously overloaded. In addition to this problem was the more serious one that this sewer discharged into Black Creek, which went dry during drought periods. The resulting nuisance at such times emphasized the need that this outlet be changed. It was deemed necessary to carry the main outfall line to the Coosa River, some four miles distant.

The necessary surveys, estimates and plans for this job were made by the writer for J. Herbert Meighan, commissioner of Public Works of Gadsden. As the details were worked out, it was decided to do the work on a day-labor basis as a WPA project. The details of the financing were completed and work was begun in January, 1936. The preliminary estimates contemplated the employment of 366 men for a period of 8 months, totalling 2,928 man-months of labor. Because of unusually severe weather during the winter and early spring, and due to flood conditions later in the spring, the schedule of work has not been maintained. As of the first part of August, the work was some 50 per cent complete.

The selection of the material for the sewer line was made with due consideration for first cost, length of life, maintenance cost, and service to local industry. The Alabama Pipe Co., which has plants in both Gadsden and the nearby city of Anniston, manufactures a cast iron pipe that is peculiarly adapted for sewer construction. The cost of this pipe being but little greater than that of commonly used types of sewer, it was selected.

This cast iron pipe is the "Atlas" type, which is light in section, but is reinforced by ribs cast around it circumferentially, and also by longitudinal ribs. The interior of the pipe is smooth, giving a high flow coefficient. The sections of the pipe are light in weight and can easily be handled without special equipment. The sections are 3 and 4 feet in length.

The joints are of the locking type. To seal them, an asphaltic compound is brushed around the inner sur-

This shows the Atlas type of cast iron sewer pipe laid and ready for backfill

Applying joint material to outside of bell

face of the bells before the pipe sections are placed and locked. After the joint has been made, the same material is applied to the outside of the bell, resulting in a simple and easily made joint that is leak-proof and seep-proof. The method of making the joints is shown in the two accompanying illustrations.

The completed sewer will require 16,453 feet of 24-inch cast iron pipe and 2,797 feet of 18-inch. Ultimately the new sewer will belt the city, serve 60% of its area, and will provide ample capacity for any probable future increase in sewage flow.

The total cost of the job as now set up and being closely adhered to is made up as follows:

The WPA has purchased materials to the amount of $22,921.62 and has approved labor to the total of $95,285.60, making a total of $118,207.22 cost being borne by the WPA. The City of Gadsden will have spent $26,766 for materials when the job is done. Making a grand total for the sewer by WPA and city of $144,973.22.

Costs of Sewage Treatment

Our editorial on this subject in the August issue brought immediate confirmation, from one quarter, of our belief that a practicable plan for making comparable cost estimates of sewage treatment plant operation would fill a long-felt want. A consulting engineer wrote as follows:

> I have read with considerable interest your editorial in your August issue on the subject of "Costs of Sewage Treatment." You have made a timely suggestion which I would like to see followed up by the two agencies you mentioned.
>
> The engineering studies are not simple for the development of project studies and the setting up of cost estimates, including the comparison of various methods of sewage treatment. Anything that could be done to insure more accurate assembling of cost data would be quite helpful.
>
> In our practice during the past ten or more years we have had occasion to use several yardsticks for comparing costs and there is a grave question in my mind that any one standard can be developed which will be useful in all cases. A sound yardstick must include some consideration of the results accomplished, or expected to be accomplished, by the treatment works under consideration. Thus, the question of plant loadings and efficiencies come into the problem.
>
> I will watch with interest any efforts which may be made along the lines you have suggested. Your further comments would be of interest.
>
> WM. E. STANLEY,
> *Greeley & Hansen, Chicago.*

We would like to hear from other consulting sanitary engineers, and the several State sanitary engineers; and also, if not even especially, from plant superintendents, for they are the ones who will be looked to for furnishing the data called for by such plan as may be adopted.

Meantime, we publish on another page an English suggestion. It is open to some criticisms (we could make a few ourselves), but we have not yet seen a plan that was not. It at least makes an effort to solve the problem of plant loadings and efficiencies presented by Mr. Stanley. (In the discussion of this paper, a member referred to a paper on "Sewage Works Operating and Cost Records" published in 1931 by the American Federation of Sewage Works Associations, as giving "a wonderfully clear definition of the terms used in cost keeping.")

Let us hear from others; if not with solutions then with definite statement of the difficulties. Often a clear, full presentation of a problem is half-way to a solution.

Harsh-Mix Roller-Consolidated Cement Concrete

Following similar experiments in Victoria and elsewhere, the Main Roads Department of New South Wales, Australia, early in 1934, laid a short experimental length of harsh-mix roller-consolidated cement concrete pavement. The mix adopted, consisting of nine parts of uncrushed Nepean gravel (2½ in. gauge to ¾ in. gauge), 2¼ parts of Nepean sand and one part of cement, was mixed in a 27E paver and consolidated with a 10- to 12-ton tandem roller. After consolidation a thin concrete wearing course was placed and belted to crossfall.

Although several difficulties were encountered the results obtained were considered sufficiently promising to proceed with further work. It was apparent, however, that the proper field for this method of construction, until finishing technique had been further developed, was as a basecourse for a pre-mixed bituminous macadam or similar surface course.

The harsh-mix roller-consolidated concrete base course has since been adopted with satisfactory results at a number of locations and constructional details have been varied as further experience with this work dictated.

On the later works the amount of steel reinforcement and the number, spacing and type of transverse joints were varied in order to ascertain the most satisfactory types and methods of construction. Difficulty has been experienced in constructing a satisfactory expansion joint owing to the difficulty of withdrawing the forming bulkhead and the best results so far have been obtained by providing transverse joints constructed with deformed metallic jointing at 50-foot intervals, together with an expansion joint at the end of each day's work. The outer edges of the slab are thickened in the customary manner and a deformed longitudinal joint is also provided. In general, steel reinforcement is restricted to the use of a ⅝-inch diameter edge bar with corner returns as adopted for normal cement concrete pavement slabs.

For the earlier work, the mix employed was 1 part of cement, 2¼ parts sand and 9 parts of either broken stone or uncrushed gravel (2½ in. to ¾ in. gauge). On the later works the amount of sand has been increased slightly from 2¼ to 2½ parts, the aggregate employed being uncrushed gravel. With this aggregate a water-cement ratio of from 0.55 to 0.75 is adopted.

The arrangement of stock piles and the mixing follows generally the procedure adopted on normal cement concrete pavement jobs. The mixing is carried out in a paver of 27 cubic feet capacity, the consolidation being obtained with a suitable 10- to 12-ton tandem roller.

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TRUCK TIRES money savers

At the left is the work shown in the sketch below. At the right is a grade crossing elimination near Kemmerer

Wyoming Highway Work

By JAMES B. TRUE

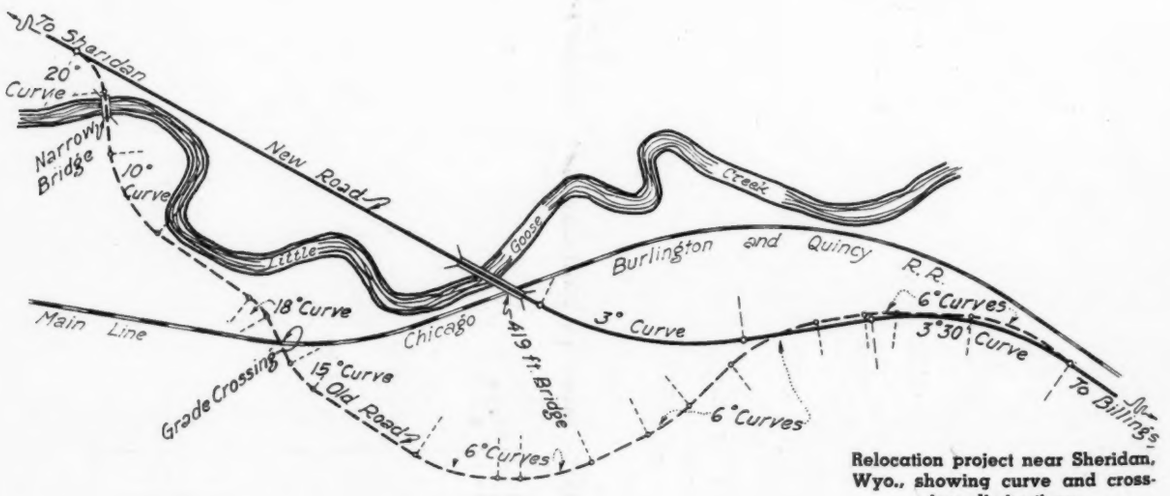
Superintendent-Engineer

WITH the increased speed of cars it has developed that many miles of the state trunk system are in need of widening. Considerable work of this nature was put under contract in 1935. Notable under this classification are the elimination of dangerous curves at three locations: between Cheyenne and Chugwater; the elimination of right angle turns west of Douglas and the elimination of the death curves in Coyote Canyon between Walcott and Hanna. A notable project was the elimination of a narrow bridge, sharp curves and a railroad crossing just north of Sheridan. This project, while only 1.7 miles long, involved the construction of a reinforced concrete and steel bridge 419 feet long over Big Goose Creek and the C. B. & Q. Railroad, as well as 122,000 cubic yards of excavation. It includes one of two grade crossing eliminations put under contract during 1935 and brings up to 88 the number of railroad grade crossings which have been eliminated by separation or relocation since the Highway Department was organized in 1918.

Grades and alignment on all the projects are now designed with long spiral or easement curves and long sight distance on summits of grades with ample width of roadway. Funds do not permit improvement of all of the highways to the standards referred to, but in putting some 96 miles of this type of work under contract at an estimated cost of $1,600,000 many of the worst danger spots and expensive maintenance sections will be eliminated with the consequent safer driving.

On many of our main highways 60 to 75 percent of the traffic is composed of out of state vehicles and the fees they pay for use of the road in the way of gasoline tax and other tolls not only maintain the roads they travel but provide revenue for the other state and secondary roads which do not themselves produce enough revenue to keep them maintained. The figures given show that these modern highways cost $17,000 per mile on the average; this does not include the surface, but it does include many expensive structures and heavy grading work such as the project north of Sheridan referred to.

Making the highway wider and straighter necessarily makes the cost per mile higher. Not only do the higher standards increase the cost but most of the construction through the easy or plains country is complete and construction now must be through hilly or mountainous country. While the unit prices on highway work have not changed, the two factors mentioned above have increased the cost per mile of state highway construction from fifty to one hundred percent.



Relocation project near Sheridan, Wyo., showing curve and crossing eliminations

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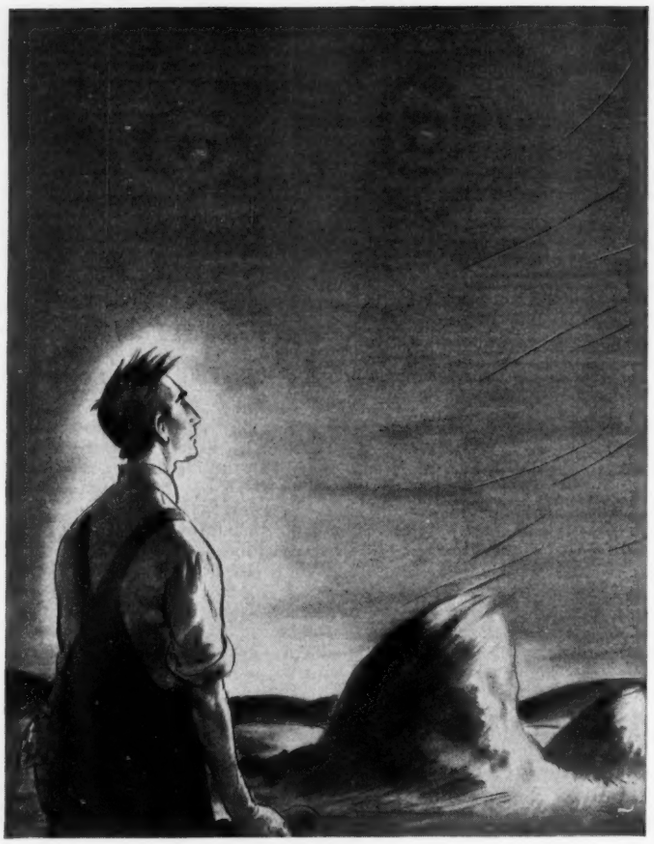
INTERNATIONAL TRUCKS

Don't forget the READERS' SERVICE DEPT.—pages 55-57



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This type of work is essential, but if the expenditure of funds were concentrated on the main system a certain class of motorists would demand a continuing improvement looking only toward the completion of a number of speedways across the state. Wyoming, however, recognizes that the trunk roads are primarily for use of the people of the state and in order to render their full service, they must be made more available by providing additional connecting state highways and feeder roads. The construction of these supplemental roads is progressing.

This second line of activity, namely the construction of additional connecting state highways, involved 157 miles of grading and bridge work at a cost of $1,446,-012. The line of demarkation between this class and the one previously mentioned is not definite but the second class covers such roads as the Gillette-Douglas, Thermopolis-Meeteetse and Kemmerer-Evanston. Much work remains to be done before the roads of this class are completed but a good start has been made toward this expansion of the state highway system.

The work on the secondary roads during 1935 consisted mainly of oiling work on those graded during 1934 although an additional 15 miles of grading work was put under way at a cost of $141,897. Of the $1,400,-000 still available for 1936 work, approximately $500,-000 is being used for the construction of 64 miles of additional secondary roads.

Oiling work put under way involved 306 miles, 78 miles of which are on secondary roads, the cost being $1,201,837. In addition to providing this new mileage of oiled roads one of Wyoming's principal industries was benefited in that a total of 10,524,554 gallons of road oil and cutback asphalt were used.

In addition to the work described above, $131,862 worth of miscellaneous work was put under way. This includes guard fence and other road construction as well as buildings, including a modern district office and shop at Cheyenne of the same type as those previously built at Casper and Sheridan.

The total amount of contracts awarded amounts to approximately $4,500,000 and as shown above, one-third was used for grading and drainage work on the main highway, one-third on the so-called new state highways and secondary roads and one-third for oiling work. Approximately $700,000 was spent for maintenance work which amounts to about $230 per mile.

An average of 1,966 men were employed on our state road work during 1935; the minimum employment occurred in January, when 1,075 were employed, and the maximum in August, when 3,257 were on the payroll.

Heat Treatment of Earth Roads

The process of roadmaking by heat treatment of soils *in situ* with a machine developed and patented by L. R. H. Irvine of the New South Wales, Australia, Main Roads Department, has been tried out for several years. The utility of the process lies principally in road construction on black soil plains and similar areas where the roads are untraveiable in wet weather and ordinary roadmaking materials are difficult to obtain. The effect of the treatment, which is carried out by the machine as it moves slowly over the road, is to destroy the plasticity of the soil and to convert a portion of it into a product similar to partly-clinkered bricks. This product, together with a proportion of partially hardened soil, is left on the road as the machine progresses and is then used as a substitute for road metal or gravel. Consolida-

tion is obtained by rolling, and after suitable binding material has been added, the result produced is equivalent to a light gravel road.

A new and larger machine was recently delivered by the Company. The design of the new machine is based on the original, but numerous improvements have been added to increase the output and facilitate its operation. Chief among these is the addition of locomotive mechanism which renders the machine a self-contained mobile unit, capable of travelling by road under its own power. This machine is capable of treating a road 18 feet wide in three traverses. Where traffic conditions warrant it, a second course can be added by burning a strip on the shoulder of the road at either side and grading the material to the centre.

A Metal Floor for a Bridge

The Pittsburgh floods earlier in the year floated off the wooden floors of a number of bridges. The bridge shown in the illustration was refloored with a steel grating, the work being practically completed when this picture was taken.

There are many interesting features of this floor. It is neat in appearance and light in weight. Drainage offers no problem and practically no snow is caught by it. No crown is necessary; it is pretty much, if not entirely, skidproof. The open spaces are small enough so that it is safe for animal traffic. The units are built in a standard size and can be adapted for any load by varying the spacing of supporting joints and stringers.

On the bridge shown, the longitudinal members are 2½-inch by 3/16-inch, the steel having a yield point of 47,000 pounds. These members are spaced 2½ inches on centers; the spacing members are 1¼-inch by 3/16, and are rivetted to the longitudinal members at every intersection. The floor is delivered in units about 25 inches wide and 25 ft. long.

Tables have been worked out for this flooring showing the joist spacing for various standard highway bridge wheel load specifications.

The material in the bridge shown was furnished by Blaw-Knox Co.

This metal floor represents an interesting development in bridge construction. No further surfacing is placed, the grating shown providing the pavement.

THIS SEWER WAS LAID

28 Feet

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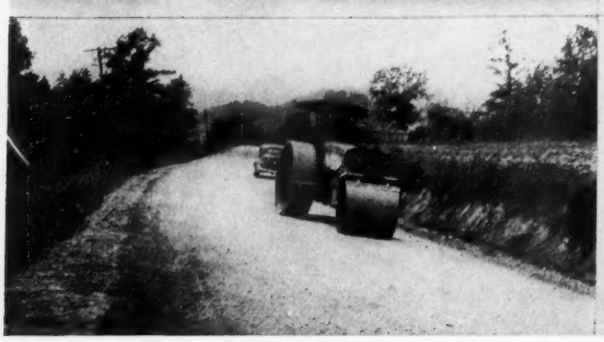
Armco Paved Invert Pipe

Don't forget the READERS' SERVICE DEPT.—pages 55-57



Top—Pressure distributor; first application in foreground. Bottom—Rolling the second application.

Top—Pressure distributor applying prime coat. Bottom—Completed road.

Bituminous Surfaced Roads in a Southern County

By W. L. DENHAM

BITUMINOUS surfacing has made possible a network of low-cost, smooth-riding, dustless roads in Jefferson County, Alabama.

A $1,200,000 program of road improvement was begun by Jefferson County in August, 1935. H. G. Culverhouse, County Highway Superintendent, under whose direction this work is being carried on, lists as chief among the twenty-three different projects, seventy-five miles of road graded and seventeen miles of bituminous surfacing.

The bituminous surface treatment is of especial interest in that the materials used are produced within the county. Slag, a by-product of the district's blast furnaces, becomes when crushed a very suitable aggregate. The tar used is manufactured locally from coal mined in the Jefferson County area.

Double bituminous surfacing has provided this county with many miles of durable and economical hard surface road. It has been used extensively for the past seven years and has proved more than satisfactory to both the tax-payer and the engineer.

The accompanying photographs show the Bradford-Pinson road in its several stages of construction. This project is typical of all the surfacing operations completed under the current program. Before reconditioning work was started, the road was narrow and the surface was badly worn.

Since the work was jointly sponsored by the WPA, it was necessary to used hand labor wherever practicable. Pick and shovel gangs did much of the work in widening and straightening the roadway. Hand labor was also used in the surfacing process, to spread the aggregate, in preference to the mechanical means ordinarily employed. Grading was accomplished through the use of two Diesel, tractor-drawn, 12-foot hydraulic-control blade graders. These were purchased by the county for use exclusively on WPA projects.

The method of surfacing is one that has been adopted as standard by the county highway department. The work is so conducted that the road can be opened to traffic after each day's operations. The stages of operation as outlined by Mr. Culverhouse are as follows: Preparation; prime coat; second application; and seal coat.

In preparation for the treatment, the graded chert surface is allowed to compact thoroughly under traffic. When compacted sufficiently, the roadway is swept clean with a power sweeper and then sprinkled daily for three days. When the surface is uniformly damp, but with no sign of free moisture, it is ready for the prime coat.

The prime coat is applied from 600-gallon pressure distributors at a rate of 0.35 gallon per square yard. Temperature is maintained uniformly at 125 deg. F. The tar is supplied "on the ground" by the manufacturer. The prime coat is allowed to stand 18 days for proper curing.

The second coat is applied at a rate of 0.45 gallon per squard yard. Temperature of the tar as applied is held at 200 deg. F. This application is covered with coarse aggregate, consisting of crushed slag, about 55 pounds per square yard being used. The spreading is done directly from trucks, hand labor being used. A five-

man follow-up gang in one truck catches any places where the main crew has left the aggregate unevenly applied.

A small crew with hand brooms then go over the surface to insure uniform distribution, and further uniformity is obtained by dragging the surface with a light steel drag broom, hauled by a 1½-ton truck.

After dragging, the coarse aggregate is rolled with a 10-ton power roller; the surface is rolled longitudinally, beginning at the outer edges and progressing toward the center. An additional 3-ton roller is kept on the job for use whenever the rate of progress is so rapid that the larger roller cannot do the job alone.

The road is kept open to traffic for 30 days before it is ready for the seal coat. For this the tar is applied at a rate of 0.3 gallon per square yard, at a temperature of 150 deg. F. Following this, a fine aggregate is spread over the surface, about 30 pounds per square yard being used. This spreading is done directly from trucks, as in previous operations.

The steel drag-broom is then again used to prepare the surface for rolling. Immediately following rolling, the roadway is ready for traffic.

Cost Accounting for Sewage Plants

THE British Ministry of Health annually publishes figures submitted to it by the several sewage treatment plants, the principal purpose of which "is to show the unit costs of sewage disposal and thus to enable comparisons to be made of expenditure over successive years on the same works and also of expenditure on comparable works and on those of a different character. Such comparisons are an important, indeed an essential, aid to those concerned with the management of sewage disposal works." However, the returns to the Ministry show such a wide disparity in unit costs as to be almost totally useless, at least for comparisons between different plants.

Discussing the subject last July in a paper before the (British) Institute of Sewage Purification, J. W. Drury and J. W. Finch suggested a method of making more reliable and useful comparisons. They first made suggestions relative to allocation to the various expense items. But it seemed to them even more necessary to select a better unit for use in reducing expenditures to a unit basis.

The units used for the Ministry of Health returns are "per million gallons total flow reaching works" and "per head of population." Said they: "It is a matter of extreme difficulty to obtain a cost unit which will serve as a means of comparison for all classes of works treating all classes of sewage, owing to a variety of factors which, singly or collectively, tend to prevent such an ideal.

"These difficulties may be easily visualized when one considers these disturbing factors: Variation in volume of sewage to be treated, strength of sewage to be treated, percentage of purification of sewage, trade wastes to be found in some sewages, subsoil water infiltration, method of disposal, and lay-out and age of plant. The compilation of an ideal sewage disposal cost unit presents a difficult and perplexing task, and it appears to be impossible to eliminate some of the disturbing factors."

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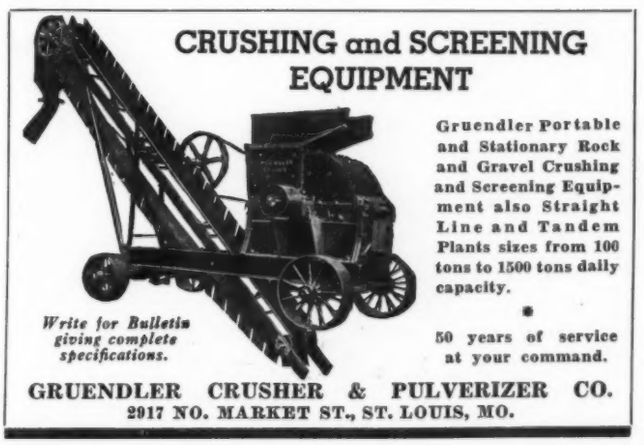
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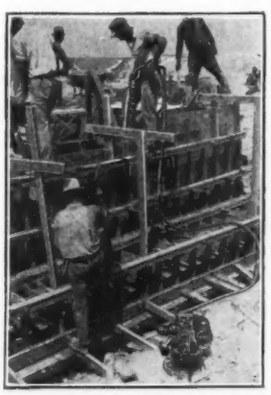
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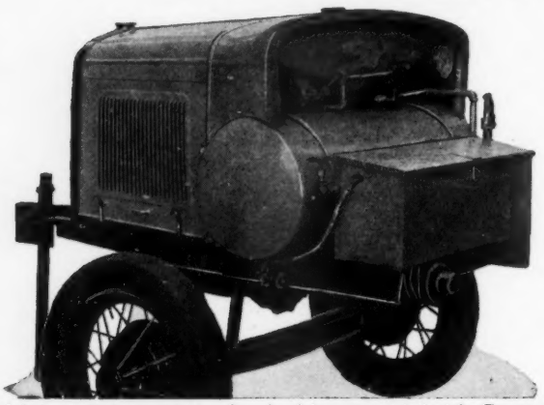

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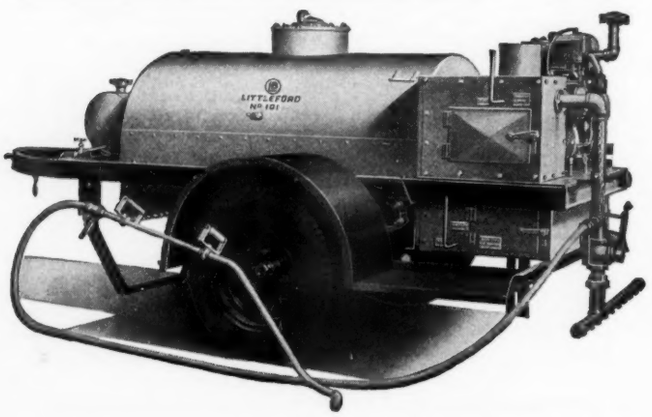

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Many small plants have no means of measuring volumes treated, but "knowledge of the volumes treated is of paramount importance in arriving at unit costs, and special efforts should be made to ensure having some reasonably accurate means of obtaining these figures."

Possibly the most controversial factor is the "strength of sewage" figure. The Ministry of Health defines it as "the measure of the amount of oxygen which a given volume of sewage required for (practically) complete bio-chemical oxidation," and is given as the strength of tank effluent in terms of oxygen absorbed from acid permanganate in four hours. "The objection to costing on crude sewage is that the percentage of true suspended matter in sewage varies considerably from sewage to sewage, and in the majority of cases is not treated in the oxidation process."

"Any test which is used to determine strength of sewage must of necessity be simple in performance if it is to be operated by both large and small works." Of 105 sewage disposal works making cost returns to the Ministry of Health, only 29 included the strength of sewage figures asked for. Because of its simplicity, the authors recommend the determination of the oxygen absorbed in 4 hours from acid permanganate at 80 deg. F.

"Percentage of purification is represented by the purification effected by oxidation processes on the actual liquor treated by these processes (i.e., sedimentaion tank effluent)," indicated "by the difference in the oxygen absorbed figure between the liquid treated and the final effluent."

Trade wastes can generally be divided into two classes—those which can be settled out in sedimentation tanks and disposed of as sludge, and those which are in true solution or colloidal suspension. The latter, for the purpose of cost accounting, can be included as part of the true load on the oxidation process.

The formula suggested for use in comparing costs is:
$A \times B \times C =$ number of sewage units, in which
A = volume of sewage in millions of gallons of dry-weather flow;
B = strength of tank effluent;
C = percentage of purification.

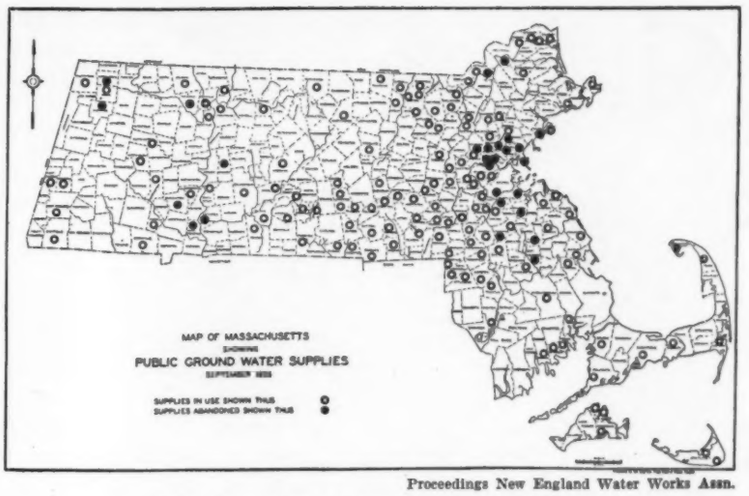
This unit can be used in determining unit costs of all processes—filters, activated sludge treatment, etc.—with the exception of screening and tank treatment and pumping. "It is suggested that the 'per million gallons' cost unit be applied to this preliminary process treatment, and 'per million gallons raised one foot high' cost unit be applied to pumping."

"The maintenance costs of disposal can be split into component parts, one being the cost of primary treatment (screening and tank treatment, including disposal of sludge), and the other being the oxidation proper"; the former being expressed in terms of millions of gallons treated, the latter in cost per sewage unit defined above.

Several criticisms of the proposed unit were expressed. P. G. Lloyd called attention to the fact that if one plant treated sewage twice as strong as another and produced a final effluent twice as strong, the former would be credited with twice as many units of result although turning out an inferior effluent. L. F. Mountfort criticized the formula because it seemed to assume that the cost of operating a plant would be proportional to the percentage purification obtained, which was well known not to be the case; for instance, he estimated that to increase purification by an activated sludge plant from 80% to 90% would necessitate increasing the size of the plant at least 50%.

The Water Wheel

Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.



Proceedings New England Water Works Assn.

Public Ground Water Supplies in Massachusetts

Ground water supplies are used by 125 Massachusetts municipalities having 958,000 population, or 23% of that using public water supplies. Water is obtained from springs in 21 municipalities, filter galleries in 18, drilled wells in 6, dug wells in 55, tubular wells in 82, and gravel-packed wells in 10. During the five years 1930-35 new installations employed springs in three cases, filter galleries in one, dug wells in 5, tubular wells in 24 and gravel-packed wells in 11.[B5]

In New England, for the larger supplies the principal dependence is on stratified glacial drifts or sand and gravel deposits. These are generally confined to narrow stringers in valley bottoms, of relatively small volume, and independent with different hydrologic characteristics, so that, while one town obtains a satisfactory supply from such a deposit, another 4 or 5 miles away may not be able to. These deposits widen and thicken toward the sea coast and one of the largest areas lies in southeastern Massachusetts and Rhode Island.[B9]

In Rhode Island 50 municipalities use ground water, the population of which is about 36,000 in winter and 65,000 in summer. Of these, springs are used in 5 cases, dug wells in 19, drilled wells in 26, driven wells in 8. (Two kinds are found in a number of municipalities.) Ten of the well supplies are chlorinated. Since 1935 all surface supplies in the state have been treated.[B4]

Dug and tubular wells are used in combination for supplying the Massachusetts State Prison Colony at Norfolk, 14 2½″ tubular wells 25′ to 35′ deep and the dug well all being connected to a single sand chamber on the suction line. The draft on the tubular wells can produce no drawdown greater than what takes place in the dug well, which in turn requires reducing the storage therein, which is 3,600 gal. per vertical foot. This permits pumping for short periods at rates greatly in excess of safe yields from the ground. This prevents undesirable velocities of flow toward the wells; also, if long-continued high pumpage lowers the ground water level it lowers it over a large area so that high velocities do not occur when the wells fill again. "A reservoir would provide storage but would have to be filled. A dug well provides a self-filling reservoir together with additional ground storage immediately adjacent."[B6]

Meter size, if not adapted to the service, may mean considerable loss in revenue. Occasionally the meter is too small; one in Winchester with a registering limit of 1 mg. and read quarterly was found to be passing more than that amount and the amount charged for was regularly 1 mg. less than it should be. Generally it is the small amounts that are not registered. A ⅝″ meter is large enough for any residence. Study of apartment buildings in Indianapolis showed that one with 48 apartments and tank toilets could have been effectively served by a ⅝″ meter although a 1½″ was used, and one with 45 apartments and flush valve toilets with a 2″ meter could have been served with a 1″ within the range of 100% accuracy. Smaller meters not only give more accurate registration and increase income, but cost less to buy, install and maintain.[A62]

Cost of centrifugal pumping depends on that of speed variation, the only way of varying the output. Variation is obtainable with steam turbine drive and diesel drive (both inherently variable-speed prime movers), with variable speed motor (generally slip ring motor with resistance control), or constant speed motor with variable speed hydraulic coupling. Variable speed motors introduce appreciable loss of efficiency; less loss is suffered by synchronous motor with hydraulic coupling. (This coupling consists of "two radially vaned discs of saucer shape, one keyed to the motor shaft and the other one to the pump shaft. Through circulation of oil by centrifugal force, power is transmitted from the impeller to the runner, there being a slip of about 2% when the coupling is full of oil. By reducing the amount of oil in the coupling, the slip is increased, so that practically any speed of the driven member can be obtained.") Another advantage of steam is the high efficiency now obtainable; instead of the former 75% boiler efficiency, designers are now aiming at better than 90%, using air heaters, economizers, more efficient boiler heat absorbing surface, better insulated furnaces, and improved combustion.[A61]

Fish in a reservoir of the Salem and Beverly, Mass. water supply, Wenham Lake, in which fishing is prohibited, "accumulated at times to the point of being a nuisance. To remedy this difficulty the State Department of Conservation has removed fish by trapping and placed them in waters open to public fishing within a radius of 25 miles. As a precaution, each man in the crew doing the work was tested to see if he might be a typhoid carrier, and the public was excluded from the areas while the work was in progress."[B2]

Silt in O'Shaughnessy reservoir, Columbus, O., 829 acres in area and 20 ft. average depth, in nine years

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equaled 6.1% of its capacity; spread evenly over the drainage area it would be approximately 0.02 in. thick. (Its rate—0.7% of its capacity per year—is less than that in several Texas reservoirs, which vary from 2.0 to 2.4%.) "If and when the existing storage becomes inadequate, it will probably be more economical to construct a new reservoir than to attempt to remove the deposit from the O'Shaughnessy reservoir. This reservoir was built at a cost per million gallons of storage of about one-fifth that of removing an equal amount of silt."[L5]

Earthquakes opened pipe joints at Helena, Mont., in 1935 in one 1,000 ft. length of 4-in. cast iron line, but in no other parts of the distribution system, although three major and several minor shocks destroyed a number of buildings. The line affected was laid in a swamp with precaulked joints, and 12 joints were loosened by the first shock, and 30 more by the second. The loosened joints were tightened by "driving the lead back into the joint."[A65]

Thawing equipment used by Chicago last winter comprised 42 portable gasoline-furnace-fired boilers generating steam at 10 lb. pressure, used for services and meters; 2 portable steam boilers on skids, steam at 10 lb. pressure, for thawing mains where large quantity of steam required for extended period; 4 portable steam boilers on trucks, steam at 20 lb., thawing mains and hydrants where large quantity of steam required; 2 steam rollers, 20 lb. pressure, where large quantities of steam are required. For electrical thawing, 21 gasoline motor-driven generators on light trucks, direct current at 30 volts 300 amp.; 10 Commonwealth Edison Co. transformer and equipment trucks, connected to company's high-voltage lines delivering 300 to 500 amp. stepped down to 110 or 55 volts. Thawed 5,400 services, 2,300 meters, 4,800 hydrants, 50 mains.[A59]

Illinois operators reported using 20 gasoline engine generators (welder type), 17 transformers, and 4 other kinds.[A60]

No fire hydrants froze in Wilmington, Del., because of thorough inspection in the fall and correction of all faults found, even the most minor ones. Fires followed up during extreme cold weather to insure hydrants are left in perfect operating condition.[A57]

Winter concrete work on purification plant at Beverly, Mass., was continuous, with 14 days of zero temperature or below. Steam, provided by two 75 h.p. boilers, was used for heating water, for warming sand by bleeding steam from 1/8" holes in a system of 1½" pipe grids under the sand on a wooden platform; for removing snow and ice from forms and stone by discharging it from a pipe nozzle on a hose line; for removing frost from soil to be excavated, by means of a similar grid under tarpaulins to which steam was supplied for 1 to 3 days. Hot water was used to remove shallow frost and to defrost forms. Concrete was produced of 70° temperature. One lot of concrete, placed at satisfactory temperature but protected only by the forms and a tarpaulin, froze before initial set; after 10 days a coke-burning salamander beneath the forms kept the temperature at 90° for 14 days; there has since been no scaling, crumbling, checking or other noticeable defect in this concrete. In all other cases, wet steam maintained the concrete temperature until it had set, being bled from perforated pipes within tarpaulin enclosures. The cost of this heating and curing of 4,645 cu. yd. of concrete averaged, per cubic yard, $1.21 for labor, 17 cts. for equipment rental, 60 cts. for coal, 47 cts. for tarpaulins and 13 cts. for pipe fittings—a total of $2.58.[B2]

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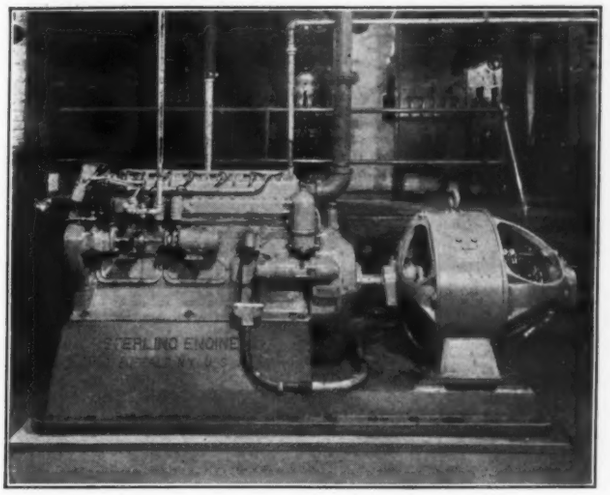

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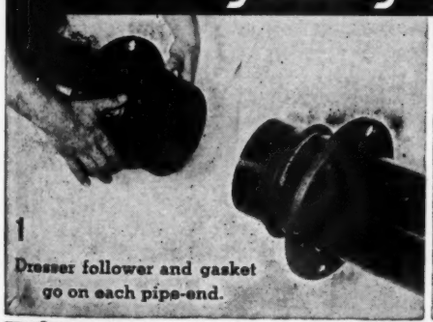
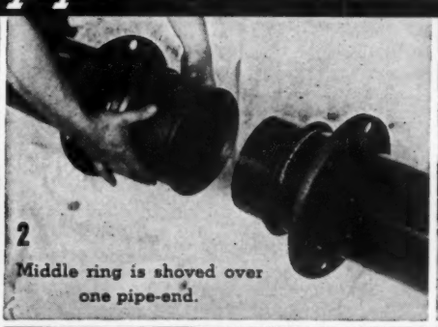
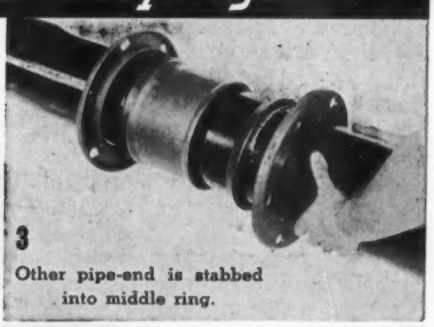


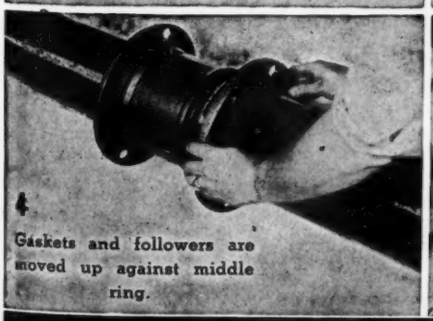
1 Dresser follower and gasket go on each pipe-end.



2 Middle ring is shoved over one pipe-end.



3 Other pipe-end is stabbed into middle ring.



4 Gaskets and followers are moved up against middle ring.

5 Bolts are inserted and nuts run up to finger tightness.

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Moving a steel tank, 75,000 gal. capacity, 25 ft. diameter, on an 80 ft. tower whose four legs were 35 ft. apart at the bottom, through a distance of 350 ft. (including a 90° turn on a 300 ft. radius) in 20 hrs. actual moving time plus 15 hrs. for raising and placing runway and 12 hrs. for lowering to the new foundation. As precaution against a 50 mph. wind, 20 tons of sacked cement was loaded onto a platform fastened to each leg, and the total weight moved was about 160 tons, at times momentarily supported on two legs. Skid timbers on the legs rested on 160 solid steel rollers 2 in. in diameter and 30 in. long, which rolled on runways of 6 x 12 timbers 2 ft. wide resting on a mat of railroad ties laid solid. For a straight-ahead pull, the load on the pulling cable was about 5 tons, about doubled by a 25 mi. head wind.[E38]

Straining water from Liverpool, England, reservoirs to remove the coarser suspended matter is effected by duplicate strainers. Each consists of a vertical cylinder of copper gauze screen 31′ 4.5″ diameter and 14′ 5″ high, 1,600 meshes to the sq. in., supported by a steel frame, set concentric in a circular concrete basin 48′ 7″ diameter and 16′ 9″ deep; the screen being surrounded by a cylindrical weir wall 41′ 6″ diameter and 13′ 6″ high. Water enters through the floor in the center of the basin, passes through the screen and over the weirs. To clean the strainer a rotary sprinkler is provided consisting of a header mounted on a central standpipe having four arms extending horizontally across the diameter and slightly above the screen, and continued vertically down the outside face, the vertical parts being provided with orifices so made that water discharged therefrom not only cleans the screen but also, by reaction, causes the arms to revolve. The wash water and screen washings flow through a bottom waste pipe to an adjoining stream.[D17]

Anthracite filters have been used in Denver for 10 years, for 2 years a filter with 6″ of Anthrafilt on 14″ of sand, and the superintendent recommends such a combination as effecting a greater saving in first cost and operation than either alone; and that air washing be employed. Mud balls and surface cracking were avoided by use of air wash prior to every second water wash.[G21]

Automatic chlorine control at Los Angeles saves $175 worth of chlorine a month. The device measures the actual residual chlorine every 3 minutes and produces a mechanical motion proportional to the increase or decrease of chlorine dosages necessary to maintain a fixed residual, which in turn makes a proportional change on the vacuum side of the chlorination orifice sufficient to change the dosage to secure the desired residual; and registers on a chart the time and direction of such change. To effect this, a test cell receiving the chlorinated water is automatically dosed with hydrochloric acid and orthotolidin solution. A 6-volt light back of the test cell shining through it onto a "photoglow" tube is gradually increased in intensity until light from it passing through the cell is sufficient to cause the tube to pass a current which shuts off the light. The amount of current used by the light before it is shut off thus measures the color intensity of the water in the test cell; the color intensity of untreated water is similarly measured, and the difference between these is converted into the mechanical motion which regulates the chlorine dose. The chlorine demand may vary 79% in a single day, which would not have been provided for by manual control. Ordinarily, with manual control, there is either frequent overdosing with possible taste and odor, or underdosing with insufficient disinfection—generally both.[F55]

Corrosiveness of boiler water used by the Northern Pacific R. R. from the Yellowstone river was caused by salts washed from the soil by irrigating water; before irrigation was practiced, the river water was soft. Complete softening extended the life of locomotive boiler tubes and flues from 12 or 18 months to 15 years or more —and a set of these costs about $2,500. The original lime-soda process is the economical method for almost complete removal of temporary and permanent hardness; refinements such as use of sodium aluminate for maximum reduction of hardness are in use, also tannin to prevent incrustation in feed-water heaters and injectors. Pressure filters with agitation and alum are used in some cases. Corrosion is combatted by carrying in the softened water a sodium hydrate causticity equal to at least 0.1 of the sum of the sodium sulphate and sodium chloride salts. Recently softening by zeolite has come into use; for waters of high sulphate hardness this usually costs less for chemicals than the lime-soda method and eliminates disposal of sludge, but the water treated must be almost clear and free from iron. Where complete softening plants are not warranted, inexpensive wayside treatment with soda ash to neutralize sulphate hardness is employed, or sodium aluminate with after treatment with tannin.[A66]

Deferrization and demanganization plants in New England are found in Massachusetts only, in Amesbury, Brookline, Cohasset, Georgetown, Lowell, Marblehead, Middleboro, and Reading; also private plants at Naushon Island and Peabody. Both iron and manganese are removed at all of these except Cohasset and Peabody, where iron only is removed. Spray aerators are used by all, and contact aerators by all but Marblehead, the depth varying from 10 ft. at Brookline, Cohasset, Lowell and Middleboro, to 1 ft. at Peabody. The rate of filtration varies from 125 mgd. at Cohasset to 7.5 at Amesbury. The iron content of the effluent varies from 0.01 ppm. at Naushon Island to 0.27 at Lowell and Middleboro. In aeration, spray nozzles or superimposed trays filled with coke are the methods generally most effective, although mechanical agitators have not been tried sufficiently to rate them properly. Other methods are perforated pans, cascades and compressed air.[B11]

Bibliography of Recent Water Works Literature

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

A *Journal, American Water Works Ass'n* *July*

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B *Journal, New England Water Works Ass'n* *June*

2. New Water Treatment Plant of the Salem and Beverly

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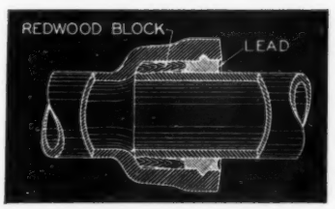

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4. Ten Years of Sanitary Improvements in Rhode Island Public Water Supplies. By C. L. Pool and J. J. Dillon, pp. 143-148.
5. Public Ground Water Supplies in Massachusetts. By F. H. Kingsbury, pp. 149-196.
6. The Water Supply of a State Institution. By B. F. Snow, pp. 197-206.
7. Procedure in Developing a Ground Water Supply by Shallow Driven Wells. By R. W. Horne, pp. 207-218.
8. Determining the Yield and Quality of Water from Tubular Wells by Means of the Well Rater and Sampler. By P. F. Howard, pp. 219-221.
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16. Trend of Water Supply Legislation and Administration. By S. R. Rafferty, p. 79.

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18. Warwick Reinforced Concrete Reservoir. By C. B. A. Turner, p. 116.

E *Engineering News-Record*

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38. Steel Water Tank on a Tall Tower Moved 350 ft. By M. C. Shedd, pp. 236-237.

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21. Experience with Anthracite as a Filter Medium. By O. J. Ripple, pp. 255-256.
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August

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A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published

The Digestion Tank

Highland, Ill., sewage treatment studies by engineers of the State Dept. of Health resulted in several interesting conclusions. The sewage flow during 1935 averaged 0.47 mgd, maximum 0.714 mgd; 45% domestic sewage, 46% milk waste and 9% brewery waste. Plant comprised sedimentation, sludge digestion, trickling filters, chlorination. Dairies contributed $10,000 to cost, brewery pays $300 a year.

Sedimentation tanks (primary) designed for 1.25 hr. retention to "keep the settled sewage fresh." Believed that filter would do better work if tanks were larger; detention period up to 2 hr. permissible if sewage arrives fresh. Relatively shallow tanks suggested "to avoid the presence of non-flowing volumes."

Digestion tank, 3.33 cu. ft. per capita (4500 persons) heated by heating small part of supernatant liquor by means of digester gas and discharging it through nozzles into lower part of digester. Spent grain in brewery wastes results in overloading the tank. Chlorine, 10 ppm, applied at screen chamber improved digester operation as well as reduced odors and scum formation in primary tank.

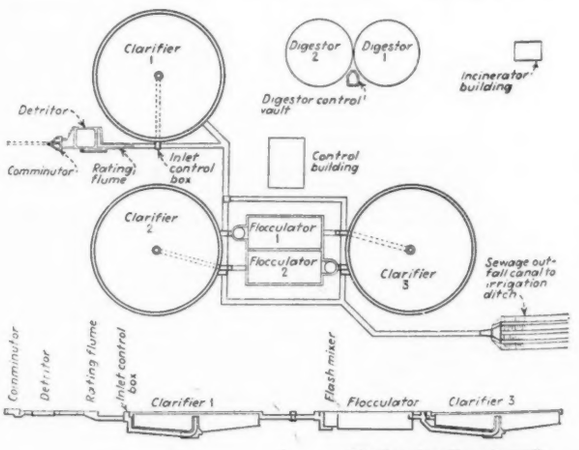
Sprinkling filter provided 60 cu. ft. of stone per lb. of milk solids in daily flow, in addition to normal allowance for domestic sewage; average daily loading, 500 lb. of 5-day B.O.D. per acre-foot (about twice the normal). Dosing tank of 14,000 gal. capacity (recently reduced to 10,000) too large, giving an unbalanced dosing cycle and reducing final settling tank efficiency; was aerated with compressed air to keep sewage from souring before reaching sprinklers. Revolving distributors admirably adapted to sewage of this type. An additional procedure for keeping sewage fresh was returning part of plant effluent to either raw or settled sewage; resulting in "a marked freshening of the sewage, reduction in odors and improvement in the plant effluent . . . very desirable in the treatment of concentrated sewage." Efficiency of final settling tank impaired by extreme flow fluctuations due to large dosing tank.[C34]

Trickling filter improvement seems probable from recent studies and modifications, such as preliminary aeration or partial activation; complete activation before or after the filter; returning part of the effluent or sludge; vacuum filters; forced draft ventilation; repeated filtering through shallow filters. Each is "an improvement of the old system. There is reason to believe that refinement and modification of any or all of the systems will allow further advances, such as by splitting the functions of a trickling filter (straining, reduction and oxidation), returning seed material in proportion to the load applied and groups of organisms desired, variation in size of mediums in relation to suspended solids removal, distribution of sewage and air, and stimulation of desirable and retardation of undesirable growth complexes."[E16]

Activated sludge of good quality can oxidize the greater part of the oxidizable soluble and colloidal matter in sewage in a period of 5 hrs.; poor sludge may require much longer. In the presence of activated sludge, the 5-hr. OD may be greater than the total first stage OD. The total OD of the sewage in the presence of activated sludge is lower than the total OD observed under the conditions of the BOD test, which probably means that a considerable amount of the material is used to synthesize activated sludge flocs. If so, the sewage cannot be considered completely oxidized until the sludge itself is disintegrated by other organisms. If nitrification is occurring, the rate of oxidation of the sewage in the presence of activated sludge can not be expressed satisfactorily by the unimolecular equation. The k value for sewage in the presence of activated sludge is 2.0, compared to 0.1 for river water.[C28]

Tapered aeration in activated sludge tanks "points a way whereby many activated sludge plants can be designed and operated more successfully and economically." Experiments by Nordell and others indicate that, no matter what the strength of sewage or supply of oxygen (provided the latter is adequate), sewage at the entrance end of the tank uses about 3 or 4 times as much oxygen as does that at the discharge end (operating tanks show 2.5 to 5.5 times), the amount falling rapidly at first and much less so at the end. At Monroe, Wis., using 6 aeration tanks in series, with mechanical aerators, those in the first three tanks were made of 7½, 5 and 3 hp., respectively, and the last three of 2 hp., giving satisfactory results. The ordinary practice of making all 7½ hp. would have given a total horsepower 110% greater with no compensating benefits.[H23]

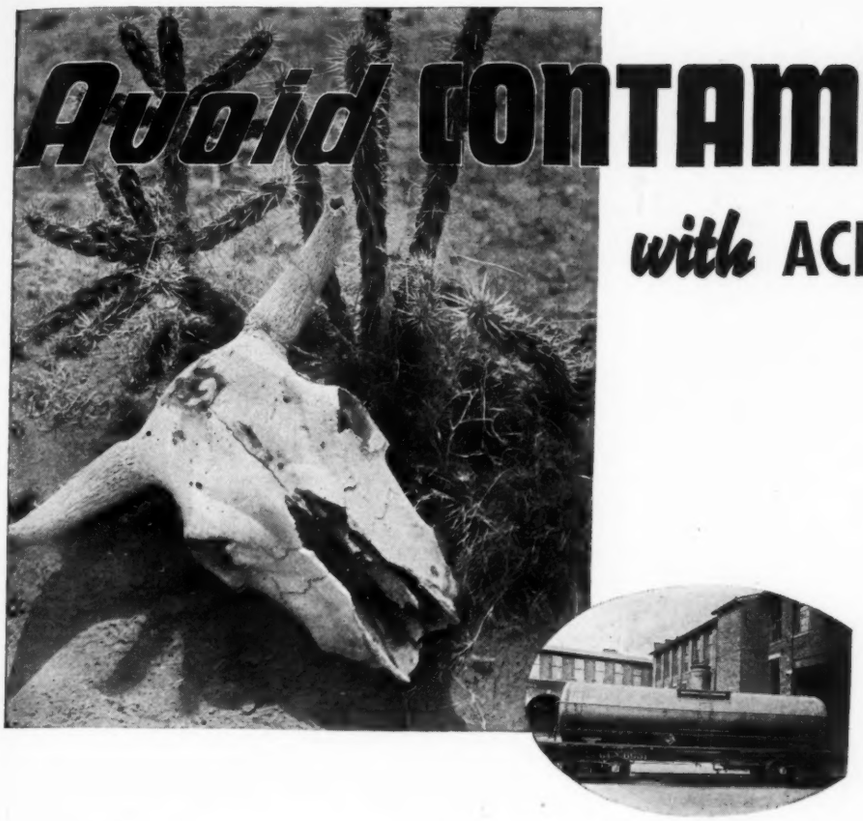
Salt water in sewage at Newport Beach, Calif., half infiltration and half discharge from fish canneries, equals twice the amount of the sewage itself. This has not interfered noticeably with sludge digestion, but produces 5 to 8 ppm of hydrogen sulphide at the Imhoff tank. (The odor of this is said to be practically killed by the fish odor from the cannery wastes.) By the use of the Scott-Darcy process the hydrogen sul-



(Engineering News-Record)

Layout of Colorado Springs chemical precipitation plant.

Avoid CONTAMINATION *with* ACE HARD RUBBER



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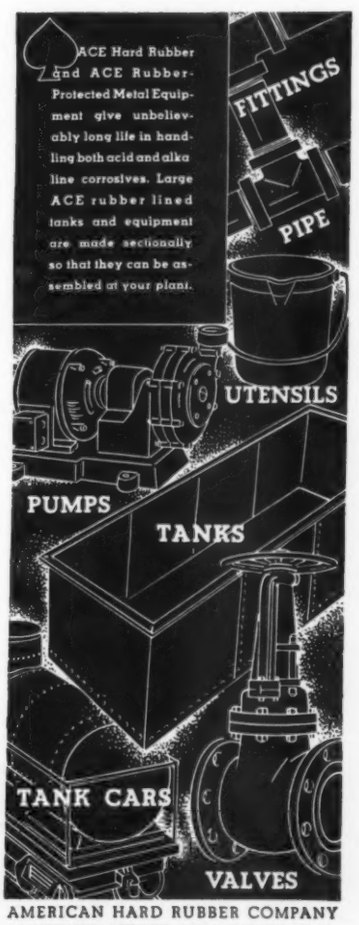
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phide is reduced to 1 to 2 ppm. On the main, 3,000 ft. above the Imhoff tank, two chambers each of 90 cu. ft. liquid capacity are filled with mashed cans and receive in series a solution of 45 lb. of chlorine in 1500 gal. of water per 24 hrs.; giving a dose of 10 to 12 ppm of ferrous chloride.[C31]

A chemical precipitation plant being built by Colorado Springs at a cost of $242,229 is designed to treat a maximum of 15 mgd during the 3-month visitor period and 10 mgd for the other 9 months. Sewage is average fresh domestic. Plant designed for removing 90% suspended solids during irrigation period and 65% and 50½ of the B.O.D. the rest of the year. High first cost, large area requirements and nearness of residences caused rejection of trickling filters; high first cost and lack of flexibility caused rejection of activated sludge; chemical precipitation considered most economical and efficient and best meeting the conditions. The plant comprises 2 comminutors; a detritor; a pre-settling clarifier with 1.4 hr. detention; 2 flash mixers with 1 min. mixing period; 2 flocculators, 30 min. period; 2 final clarifiers, 2 hr. detention; primary and secondary digesters, combined storage, 60 days. (All figures are minimums; which increase during winter sewage flow or by changing procedure.) Also 2 solution type chlorinators, each 400 lb. per hr. capacity; 2 chemical feeders. Also sludge and garbage multiple hearth incinerator with capacity of 4 tons per day (dry basis) of sludge and 6 tons of milled garbage; the sludge digested and vacuum-filtered to 70% moisture; digestor gas used for combustion.

For partial treatment, sewage from clarifier No. 1 passes in succession through flash mixer and flocculator No. 1, clarifier No. 3, flash mixer and flocculator No. 2, receives chlorine and passes through clarifier No. 2; no other chemicals will be used. For complete treatment, settled effluent receives conditioning reagent plus return sludge; flash mixer and flocculator No. 1; clarifier No. 3; flash mixer No. 2 (receiving chlorinated copperas); flocculator No. 2; clarifier No. 2. Sludge from clarifiers No. 2 and 3 will be thickened in No. 1.[E15]

Sludge drying gases, by the odors disseminated, gave more trouble than any other feature of the treatment works at Pasadena, Calif. Destruction of the gas odors by incineration cost about $7,000 a year for fuel —nearly as much as that for drying the sludge. In continuous operation since Nov. 4, 1935, has been a "Royster-Cottrell deodorizer," fuel for which costs 36 cts. per ton of fertilizer produced, as against $2.24 a ton by stack incineration; a saving of $6,000 a year. The deodorizer could be duplicated for $16,500. In operation, 90% of the dust is removed from the gases by spray and they are passed through a pair of deodorizers which raise the temperature to 1200°+ and reduce it to 150° to 200°, at which temperature it is discharged into the atmosphere. Each of the two deodorizers is a cylinder 17 ft. diameter by 10 ft. high lined with brick, filled with 6″ to 1½″ stone, on which is a cone-shaped combustion chamber, the two chambers being connected by a 5-ft. flue. An exhaust fan forces the drying gases up through the rock in one unit, across and down through the other. The rock in the former is first heated (by burning fuel gas in the combustion chamber) to 1200°. The drying gas is heated in passing through this and gives up most of the heat to the second unit; the direction being reversed when the emerging temperature reaches 200°. Once in 2 days

For the NATION'S CAPITAL

Twelve 106 ft. DORR SIFEED CLARIFIERS

Not many miles from the dome of the Capitol, Washington's new separate sludge digestion plant at Blue Plains, D. C., financed by P.W.A. funds, is rapidly being completed by John W. Cowper Company, general contractors. The District of Columbia's board of engineers, reporting on this project, consisted of Metcalf & Eddy of Boston, John H. Gregory of Baltimore, and Greeley & Hansen of Chicago.

Significantly, 12 Dorr Sifeed Clarifiers, each 106 ft. in diameter, were selected for settling Washington's ultimate flow of 130 MGD. Dorr engineers, too, have been engaged to supervise the erection and to supervise the initial operation of these clarifiers during the crucial breaking-in period.

The Dorr Company, with an installed capacity of over 3 billion gallons a day, has pioneered virtually every advance in the mechanical handling and treatment of domestic sewage since 1914. That is but one of the reasons why Dorr equipment has been chosen for the country's largest plants at Chicago, New York, Cleveland, Los Angeles, Baltimore, and Washington.

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Construction picture of Washington's new sewage treatment plant.

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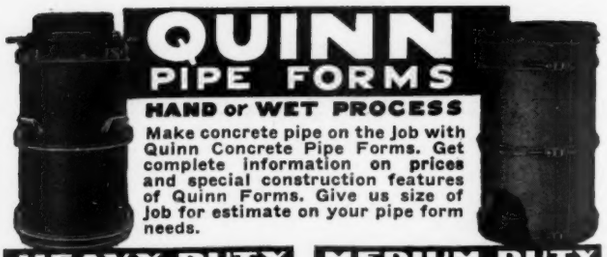

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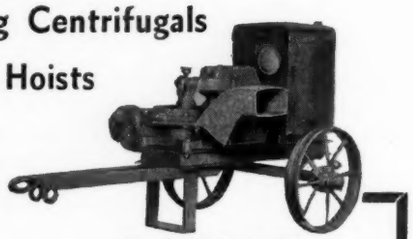

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the stone beds have to be cooled by allowing the 1200° gas to pass directly to the atmosphere for 15 minutes.[C30]

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c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

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30. Incineration of Stack Gases at the Pasadena Sluge Drying Plant. By A. W. Wyman, pp. 592-596.
31. Infiltration into Sewers and Hydrogen Sulphide Control at Newport Beach, Calif. By R. L. Patterson, pp. 597-600.
32. Observations on the Operation of Sewage Treatment Plants. By C. C. Agar, pp. 601-608.
33. Experiences with Digester Foaming. By H. E. Schlenz, pp. 609-623.
34. Treatment of Sewage Containing Milk and Brewery Wastes at Highland, Ill. By W. H. Wisely, pp. 624-633.
35. A Study of the Pollution of a Shellfish Producing Area. By A. P. Miller, pp. 634-646.
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38. Gas Engine Operation at Los Angeles. By C. F. Tennant, pp. 658-659.
39. Sewage Treatment of the Aurora, Ill., Sanitary District. By W. A. Sperry, pp. 659-664.
40. Annual Operation Report, Sanitary District of Springfield, Ill. By C. C. Larson, pp. 665-673.
41. Value of Laboratory Tests for the Control of the Activated Sludge Process. By C. W. Klassen, pp. 673-676.

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35. The Knostrop, Leeds, Sewage Disposal Works, pp. 87-88.

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15. Low-Cost Chemical Precipitation. By B. Lowther, pp. 229-231.
16. Improving Performance of the Trickling Filter Process. By W. Rudolfs, pp. 231-232.
17. Cross-Connection Hazards at Sewage Disposal Plants. By C. E. Keefer, p. 237.

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19. Controlling Rate of Withdrawal and Return of Activated Sludge. By F. L. Flood, pp. 266-267.

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27. Industrial Waste Problems Studied in Wisconsin, pp. 281, 283.
28. Status of Sewage and Industrial Wastes Disposal in New Mexico and Texas. By P. S. Fox and E. H. Pearl, pp. 282-283.

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4. Le Calcul des Egouts. By M. Bertharion, pp. 122-124.
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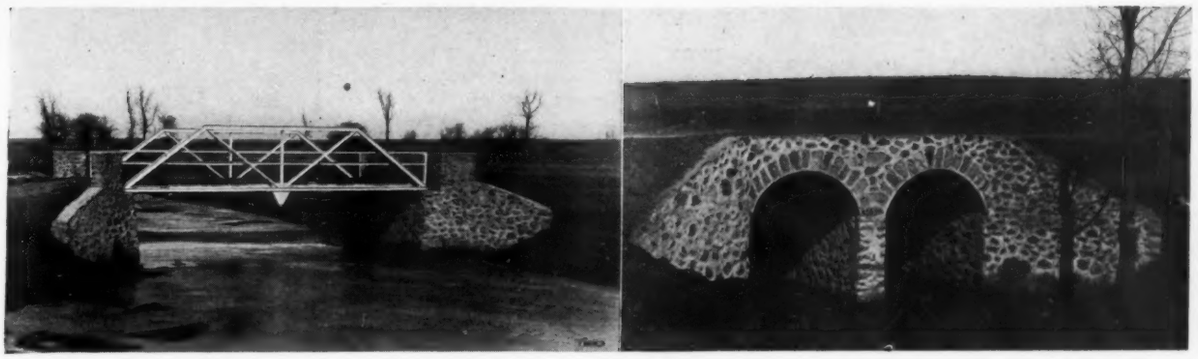


At left, abutment built of local rock, and, at the right, a rock arch bridge

Rock Bridge Construction by Relief Labor

By GEORGE R. PASCO
Superintendent of Highways, Turner Co., S. D.

IN handling relief labor in our county, we have endeavored to outline a work program where the work would be both interesting to the laborer and of value to the taxpayers.

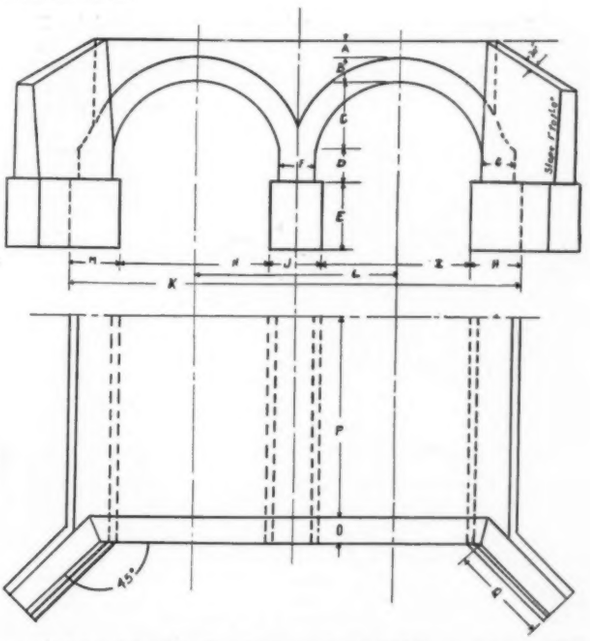
As we had a great number of small wood bridges in our county which had to be replaced or repaired, we worked out a plan of building rock bridges. We were very fortunate to have a number of good rock masons in our county, and with the help of a bridge foreman, we set up a plan which furnished an unlimited amount of work for relief. We began building these rock bridges in July, 1934, and up to the present time we have completed sixty-five bridges of the following sizes: single arch bridges from six to ten feet in width; twin arch bridges from eight to ten feet in width; also abutments and center bents for sixteen to eighty-foot steel structures.

Each bridge crew consists of from ten to fifteen men with one foreman. Part of the crew is employed on the bridge and the other part for hauling rock, sand and cement. A truck is used for hauling the material.

Footings are put in at least four feet deep, ranging in width from thirty inches to six feet, depending on the size of the bridge. Side walls are built from two to five feet thick at base, tapering to two feet at the bottom of the arch, and ranging in height to as much as seven feet. The arches are built to a thickness from one foot to eighteen inches. Head walls and wings are in proportion to size of bridge for thickness and length. The forms for the arches have the following heights: 6 ft., 26 in.; 8 ft., 36 in.; 10 ft., 48 in. Head walls are raised only one foot above arch. After the fill is made over the bridge, there is no obstruction to interfere in snow removal.

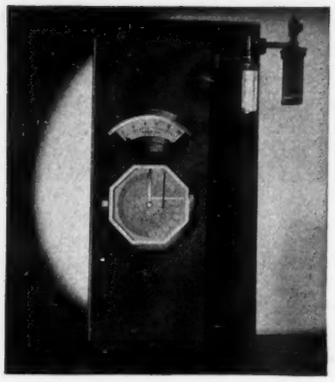
In constructing the arch forms, we used old 3 x 12 bridge plank at the bottom and 1 x 12 for the remainder of the arch, fastened together with 1 x 6 upright boards. Also a 1 x 6 on each side of upright from top to bottom corner of arch. These arches are set on dog legs at top of side wall, a distance of four to five feet apart, depending on length of bridge. We use 2 x 6 for covering this arch, which leaves a very smooth surface in the arch when the bridge is completed.

We have operated a number of different kinds of projects in our county, such as building dams, cutting hills, and gravelling roads, but have found this rock bridge project to be one of our most popular. With this type of construction, our rock bridges cost only approximately one-fourth of what our concrete and steel structure bridges cost us. This type of work is also very interesting for the men, as the average bridge does not take more than three to four weeks to construct; therefore, the men are moved about to different locations and by doing this, we find a great deal more interest taken in the work.



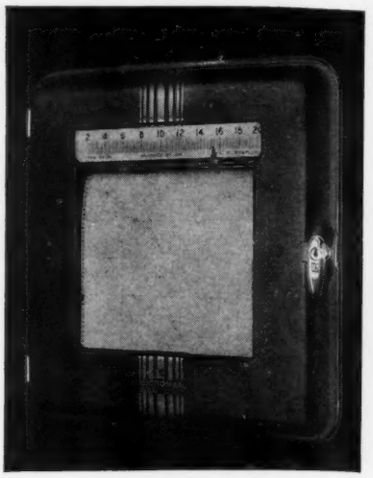
A—Height of headwalls above arch. B—Thickness of arch (12" to 18"). C—Height of arch (6' arch—26"; 8' arch—36"; 10' arch —48"). D—Sidewall (from 0 to 7'). E—Depth of footing (4'+). F and G—Width of sidewalls (2' to 5'). I and N—Distance between footings. H, J and M—Thickness of footings (30" to 72"). K—Length over all. L—Center to center of arches. O—Thickness of headwalls (approximately 18"). P—Width of bridge (depends on width of road). Q—Length of wings (6' to 12')

New Equipment Illustrated

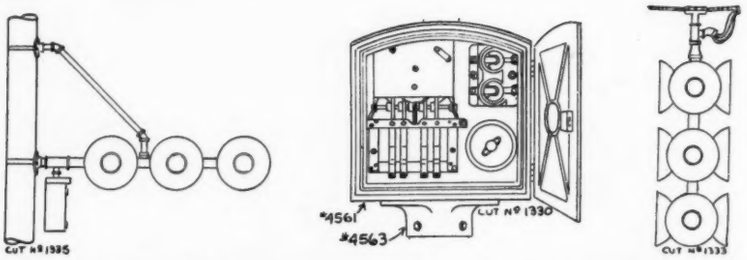


The CO_2 meter of the Republic Flow Meters Co., Chicago, Ill., registers simultaneously on a single chart steam flow, CO_2, and flue gas temperature. Readings are directly in CO_2 percentages. There are many excellent points in design which are covered fully in Data Book 403, which will be sent on request.

This is the Sullivan Truckair Compressor. It consists of a compressor of 105 c.f.m., enough to operate a rock drill or two pavement breakers, mounted on a truck. Power takeoff from truck propeller shaft. Most of truck space can be utilized for men, tools and materials. Ask for Bulletin A-14, Sullivan Machinery Co., Michigan City, Ind. Handy for city and county work.

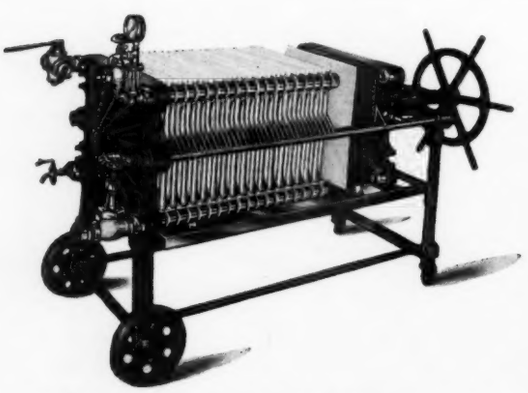


The silver anniversary Micromax recorder, just announced by Leeds and Northrup of Philadelphia, provides in one instrument all combinations of indicating, recording, signalling and controlling. Bold scale and chart show conditions at the moment; continuous strip records it. Send for catalog N-33A.



Some of the Reco Traffic Signals manufactured by Reynolds Electric Co., 2650 West Congress St., Chicago, Ill. At left is shown the 2-way horizontal bracket mounted signal; in the center the control cabinet that houses the control mechanism of these signals; and on the right a 4-way overhead center suspended signal. Full data sent on request.

This flashlight differs from others in a number of ways. There is no button, slide or knob of any kind. A flick of the wrist operates an inertia switch. They are also water proof, gas tight and explosion preventing. No sparking to set off gas. Approved by Bureau of Mines for safety in methane and air mixtures. 10 days under water in the Pittsburgh flood, with no damage. Standard bulbs and batteries are used. Looks like every sewage plant could use one. Further data from Inertia Devices, Inc., 370 Broadway, Albany, N. Y.



This is an illustration of the Seitz filter which was mentioned in an article on pages 20-22 of the August issue of Public Works. The filter is shown with one section opened. Otherwise it is ready for operation. Paper pads are used as a filter medium and results in clearness and low bacterial counts are quite remarkable. This filter should be excellent for estate and home water supplies and perhaps also for swimming pools where a high quality of water is to be maintained at all times. It is made by the American Seitz Filter Corp., 31 Union Sq., New York, N. Y.

The Caterpillar Tractors up in the Matanuska Valley, Alaska, have to work under severe winter conditions. This shows the fleet on its first service anniversary. A little touch of this weather mixed with the current brand of temperature would feel nice.

PAGE *traffic* TAPE

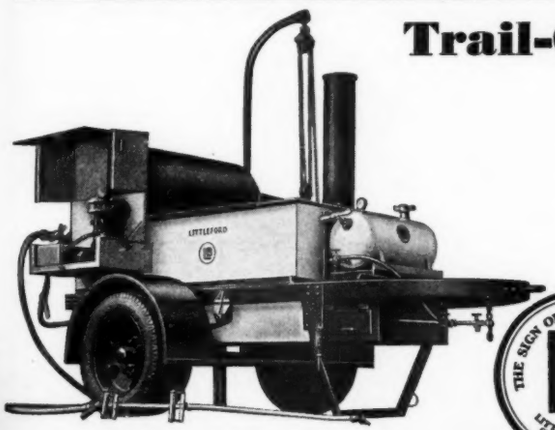
• Motorists favor Traffic Tape because these resilient bands of steel wire stop cars with a cushioning action. This action not only protects the life of the motorist but assures less damage to his car.

PAGE Traffic Tape is as flexible in application as it is in resistance to impact. . . . Here—in this illustration—four strong, tough, flexible bands of Traffic Tape guard the motorist from the hazards of the deep gorge that parallels the highway. . . . Where the hazards and the traffic are less, ample protection is provided by three or in some cases only two strands. . . . It is this flexibility of application, plus the low cost of erection and maintenance, which appeals alike to taxpayers, highway engineers and contractors. Samples will be sent upon request.

PAGE STEEL & WIRE DIVISION OF THE AMERICAN CHAIN COMPANY, INC., MONESSEN, PENNSYLVANIA

District Offices: New York, Pittsburgh, Atlanta, Chicago, San Francisco

In Business for Your Safety



No. 78-OB Kettle

Trail-O-Heater No. 78-OB with New Motor Spray

This 300 gallon heating kettle has "double heat circulation." With the motor spraying attachment, it is the answer if you have large maintenance problems. Ask for prices and data.

THE SIGN OF A GOOD HEATER — LB — LITTLEFORD BROS. CINCINNATI, OHIO

LITTLEFORD

Road Maintenance Equipment

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Air operated vibrators for all classes of concrete construction including Bridge deck slabs, Dams and Locks, Highway pavement and Concrete products.

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TEANECK NEW JERSEY

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We welcome an opportunity to quote on your requirements.

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Catch Basin Grates
Curb Inlets
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Manhole Steps and other Steel Castings

NOISELESS, DURABLE HIGHWAY CASTINGS

THE WEST STEEL CASTING CO.

CLEVELAND, OHIO

Don't forget the READERS' SERVICE DEPT.—pages 55-57

THE CATALOG PAGE

Remote Measurement Meters:

A new booklet describing electric flow meters for remote measurement of steam, water, gas and other fluids. The galvanometer null method of measuring is explained, and styles of apparatus for different applications are shown. Bulletin 2096, Cochrane Corp., North Philadelphia, Pa.

A Rubber Paint:

A brushing rubber paint that bonds to etched and sand-blasted metals, concrete, etc., is immune to caustics, remarkably resistant to acids and fumes, and can be made in many colors has been announced by Collord, Inc., 1430 Rosedale St., Detroit, Mich. This paint is called Surfaseal; it is applied by brushing, and dries quickly with a smooth and glossy finish. It comes in two grades for varying requirements. Write to the above address for complete data.

Iron and Steel Enamel:

Air-drying enamels especially designed to prevent the corrosion of iron and steel has been developed by Maas & Waldstein Co., 420 Lexington Ave., N. Y. These enamels form a hard, tough coating that is resistant to wear and have a pleasing appearance. They are particularly effective for protection against humidity, salt water, alkali, electrolytic action and a variety of chemicals.

Building Airports:

Issued by Le Tourneau, Peoria, Ill., and relates to construction and equipment to do the work. Beautifully illustrated. Copy on request.

Trenchers and Backfillers:

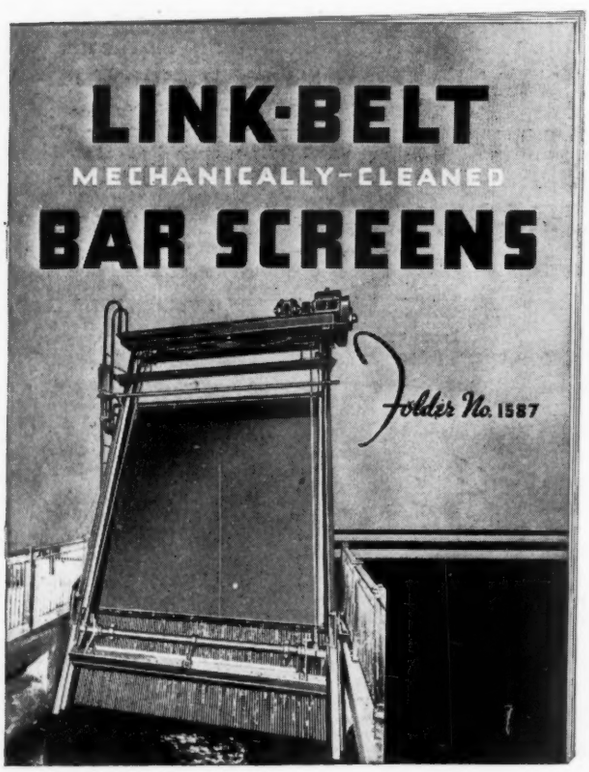
For those who wish to trench and backfill economically, there are three important catalogs available from the Parsons Co., Newton, Ia. Two of these cover trenchers, giving plenty of data and many illustrations. The third covers the new Model 23 backfiller. Copies of these three on request.

Overhead Track Systems:

Richards-Wilcox Mfg. Co., Aurora, Ill., have issued a 32-page catalog on overhead track systems, suitable, we believe, for sludge handling and especially adapted to all material handling.

Catalog "G":

This doesn't refer to "G-men," but to shovels made by Bay City Shovels, Inc., Bay City, Mich. It is another of those top-notchers in appearance and typography; lots of dandy pictures; also complete specifications, working range diagrams and illustrations of the entire line of Bay City shovels, cranes, draglines and trench hoes in 10 sizes, and models, ⅜ to ¼-yard; also trailers and truck mounted machines; sent on request.



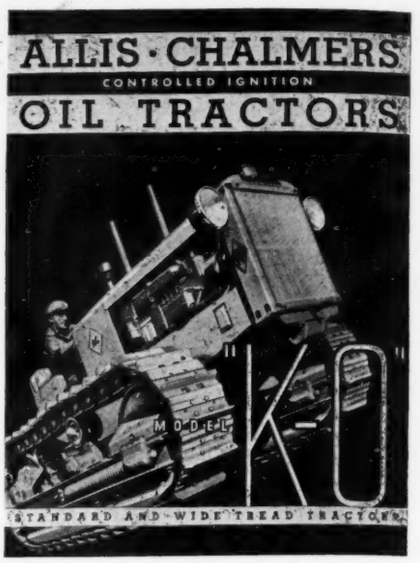
Complete data on these mechanically cleaned bar screens, dimensions, construction diagrams, are available in the booklet illustrated herewith. Write Link-Belt Co., Chicago, Philadelphia, or other office for a copy.

Mack Trucks:

Data Sheets and Specifications, dimensions and other information on Mack trucks in new models and new sizes are available on request. Write Mack Trucks, Inc., 25 Broadway, N. Y.

Brushes:

Artist, sign-writers and all kinds of paint brushes for industrial and other work are described in a 48-page catalog issued by David Linzer & Sons, Inc., 10 Astor Place, N. Y.



This shows the cover page of an excellent bulletin just put out by Allis-Chalmers, Milwaukee, Wisc., which gives lots of information on these controlled ignition tractors. Some details you will be interested in. Write A-C for a copy.

Screw Pumps:

Where large quantities of water must be handled, the screw pump should be considered. Efficiencies in excess of 90% are reported in handling sewage and drainage water, and in irrigation service. The new bulletin on 20" to 40" screw pumps will be sent on request to Morris Machine Works, Baldwinsville, New York.

Bituminous Distributors:

A new and excellent catalog of bituminous distributors. Includes complete specifications, description and helpful data. Write Kinney Mfg. Co., 3533 Washington St., Jamaica Plain, Boston, Mass.

An Inside View:

This 8-page catalog tells about the insides of Pioneer Jaw Crushers. If you want to see the digestive apparatus considered necessary to subsist on a diet of stone, write for this. Pioneer Gravel Equipment Co., Minneapolis, Minn.

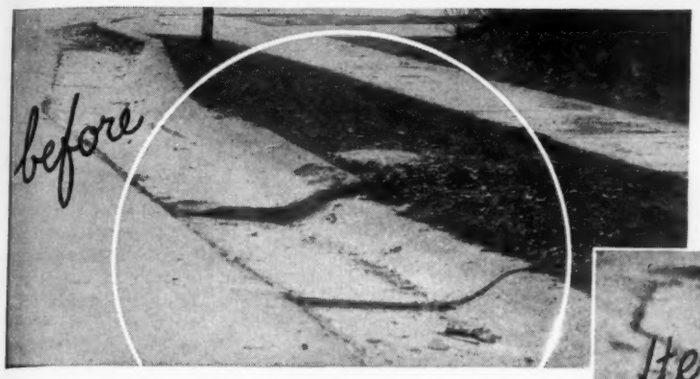
Instruments:

Brown Instrument Co., Philadelphia, Pa., have issued "Instruments from the Executive Viewpoint" and "Modernization The Trend in Industry." Either or both sent on request to J. F. Sullivan at above address.

Centrifugal Pumps:

Non-clogging centrifugal pumps for handling pulpy materials such as sewage and paper pulp, are described in a new bulletin just published by Morris Machine Works. Explains the construction of these pumps in detail, shows exterior and interior views, and includes complete table of dimensions for both horizontal and vertical types. Copies from Morris Machine Works, Baldwinsville, New York. Ask for Bulletin 161.

MUD-JACK METHOD
for raising concrete curb · gutter · walks · street



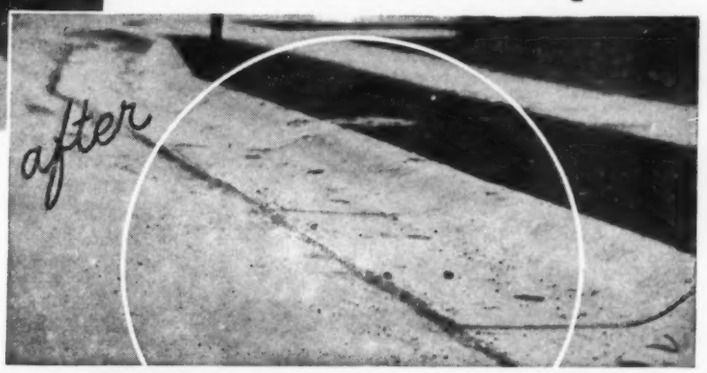
Sunken Curb and Gutter Marked for Reconstruction

but

THE MUD-JACK METHOD *corrected the settlement and saved the reconstruction costs*

Save CURB — GUTTER
WALKS — STREETS

The Mud-Jack method saves the slab —corrects the subgrade—eliminates pedestrian hazards. Write for data to reduce maintenance expense.



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Draglines · Dumptors · Mud-Jacks
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In Cleveland it's
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In Toledo it's
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In Savannah (Ga.) it's
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In Miami Beach it's
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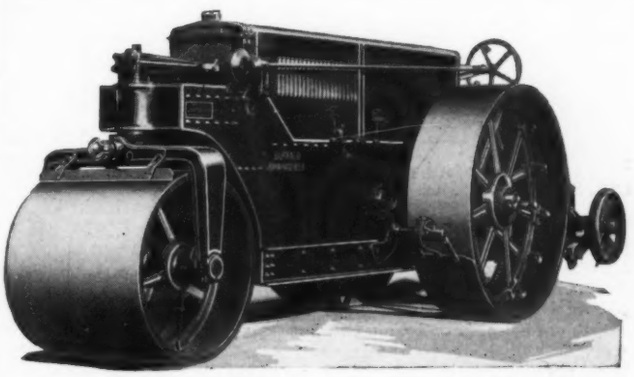
DeWitt Operated Hotels
feature
Unusually Comfortable Rooms at Reasonable Rates, and the finest of Food and Beverages, Carefully Prepared and Served.

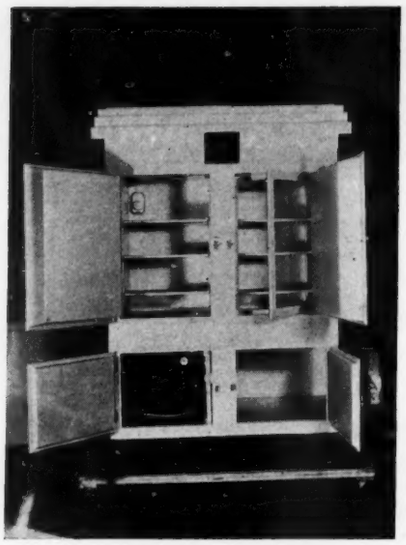


ESSENTIALS

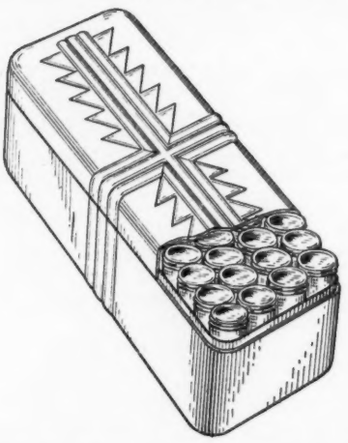
● Long life and low operating costs should be considered above all other features in the selection of a road roller. Buffalo-Springfield's ability and reputation for furnishing these essential qualities have remained unchallenged for forty-five years.

THE BUFFALO-SPRINGFIELD ROLLER CO.
SPRINGFIELD, OHIO

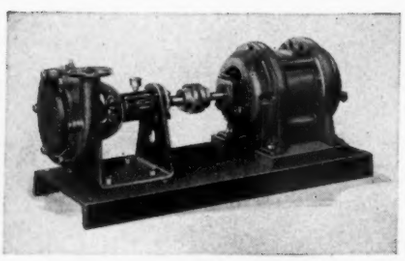
When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 55-57



Combined 20" incubator and refrigerator. Phipps & Bird, Inc., Richmond, Va. Consists of two insulated chambers. One provides a temperature as low as 5° C; the other a temperature of 20° C. The refrigerator may be operated independently of the incubator. Fine for B.O.D. determinations.



Chemical Publishing Co., Inc., 148 Lafayette St., New York, has brought out the above sample case, which is a very fine one indeed. Holds 56 vials or samples, each 2½" x ¾". Black bakelite case. Vials are aluminum capped, and caps can be written on with pencil, so no labels are needed. Vials are of unbreakable hycoloid and entire outfit is unbreakable, water proof, oil proof, soil proof and light in weight. Fine for gathering and displaying samples. Write manufacturer for complete data sheet.



Worthington Pump & Machinery Corp., Harrison, N. J., have an excellent folder on this centrifugal pump for handling acids. Made of acid resistant steel; heads up to 70 feet and capacities up to 130 g.p.m.

New England Water Works Association

The preliminary technical program of the association, which will hold its annual convention at the Hotel Pennsylvania, New York City, September 22 to 25, is as follows:

Tuesday, Sept. 22: 5:00 p. m.: "The Development of the Water Supply of the city of New York," Joseph Goodman, Acting Chief Engineer, Dept. of Water Supply, Gas and Electricity. "Additional Water Supply for the city of New York," Walter E. Spear, Acting Chief Engineer, Board of Water Supply. "The Development of the Ground Water Supply of the City of Dayton, Ohio," Wallace W. Morehouse, Director, Department of Water, Dayton, Ohio.

Wednesday, Sept. 23: 9:30 a. m.: Committee Reports. 9:30-12:30: Symposium on the 1936 Floods in Northeastern United States. *Public Health Aspects,* Anselmo F. Dappert, Assistant Engineer, N. Y. State Dept. of Health; W. L. Stevenson, Chief Engineer, Penna. State Dept. of Health; F. H. Waring, Chief Engineer, Ohio Dept. of Health; A. D. Weston, Chief Engineer, Mass. Dept. of Public Health; H. F. Hutton, Wallace & Tiernan, Newark, N. J. *Hydrology:* Montrose W. Hayes, Chief, River & Flood Division, Weather Bureau, Washington, D. C.; Robert E. Horton, Consulting Hydraulic Engineer, Voorheesville, N. Y.; Caleb M. Saville, Manager and Chief Engineer, Water Bureau, Metropolitan District Commission, Hartford, Conn.

Thursday, Sept. 24: 9:30: Committee Reports. 9:30-11:45: Symposium on Water Purification: "Experimental Studies with Anthra-Filt," H. S. R. McCurdy, Chief Engineer, Philadelphia Suburban Water Co., Bryn Mawr, Penna. "The Katadyn Process of Water Purification," Frank E. Hale, Director of Laboratories, Bureau of Water Supply, New York City. "Improving the Operation of Rapid Sand Filters," John R. Baylis, Physical Chemist, Department of Public Works, Chicago, Ill.

11:45 a. m.-12:30 p. m.: "Recent Droughts in Great Britain," H. J. F. Gourley, Past President, Institution of Water Engineers and Consulting Engineer, Binnie, Deacon & Gourley, London, England.

2-5:00 p. m.: Superintendents' Session: "How to Run a Water Works Without Revenue," J. McC. Wardle, Supt. Water Works, Hudson, N. Y. "The Use of Couplings," Rossiter Scott, New York. "A Slow Sand Filter Built by W.P.A. Labor," H. L. Field, Engineer and Supt., Water Dept., Greenfield, Mass. "A Rapid Sand Filter Built by W.P.A. Labor," W. Guy Classon, Supt. and Registrar, Water Dept., Leominster, Mass. "Pipe Linings," Thomas F. Wolfe, Research Engineer, Cast Iron Pipe Research Association, Chicago, Ill.

Friday, Sept. 25: 9-9:30 a. m.: Report of Tellers, presidential address, introduction of new president. 9:30-12:30: Superintendents' Round Table. Meter Masters, the "G-Men" of the Water Works, Roger W. Esty and John A. Read.

The tentative entertainment program includes an inspection trip over the liner "Queen Mary" on Tuesday forenoon; a luncheon at the hotel with a welcome by Mayor La Guardia; an informal reception and dance Tuesday evening at the hotel; a boat trip on the Hudson and East Rivers Wednesday afternoon; a smoker at the hotel Wednesday evening; a golf tournament Thursday and a dinner dance at the hotel Thursday evening. W. W. Brush, Editor of Water Works Engineering, is chairman of the Entertainment Committee.

Columbia Alkali Enters Liquid Chlorine Field

The Columbia Alkali Corporation announces that liquid chlorine and electrolytic caustic soda have been added to the products of this concern. Already, a complete new plant has been finished and shipments are now being made in single and multiple tank cars, and in 100 and 150 lb. cylinders.

The new chlorine plant is located on the Company's property at Barberton, Ohio, well removed from other plant operations. The greatest care has been taken to protect the operators in the plant and users of the product from hazard. Equally great care has been taken to prevent any variation in quality.

The importance of liquid chlorine is increasing rather than diminishing. It is indispensable to a wide variety of industries. Leading uses of liquid chlorine include water purification and sewerage disposal; bleaching of pulp and paper; the finishing processes of many textiles; and as a raw material in the production of many industrial chemicals. For nearly half a century The Columbia Alkali Corporation has manufactured soda ash, caustic soda, and by-products and it is a logical and natural development that chlorine should be added to the line. The executive offices of The Columbia Alkali Corporation are located on the 43rd floor of 30 Rockefeller Plaza (Radio City), New York. Branch sales offices are maintained at Chicago, Pittsburgh, Cincinnati, and at the plant at Barberton, Ohio.

Bingham Joins Columbia Alkali

Chris Bingham, formerly operator of the Richmond, Va., waterworks plant, and very well known to all waterworks men, has been appointed sanitary engineer of The Columbia Alkali Corp., with offices in New York City.

Readers' Service Department

CONTINUED FROM PAGE 56

These booklets are FREE to readers of PUBLIC WORKS.

Couplings for Pipe

386. This sixteen-page booklet is a reprint of a magazine article by a consulting engineer. It describes in detail the installation of a 42" water line; contains specific information regarding pipe joints, field organization, laying pipe, tests, back-filling, etc. Sent free by S. R. Dresser Manufacturing Company, Bradford, Pa.

Fire Hydrants

388. Two new bulletins on M-H fire hydrants and fully bronze mounted gate valves are now ready. Contain full specifications and instructions for ordering, installing, repairing, lengthening and using. Write M. & H. Valve & Fitting Co., Anniston, Ala.

Gate Valves

390. 28 page catalog contains illustrations and complete specifications of M-H standard and extra heavy iron body gate valves, horizontal swing check valves, flanged fittings and flanges, etc. Sent promptly on request by M. & H. Valve & Fittings Co., Anniston, Ala.

Glass Covers

393. Full details regarding the use of Lord & Burnham Glass-Overs at Middletown, N. Y.; Marion, Ohio; Cleveland, Ohio; Freeport, N. Y.; Kitchener, Canada; West Chester, Pa., and other places are given in bulletins 22 to 33. Sent promptly on request to Lord & Burnham Co., Irvington, N. Y.

Laboratory Equipment

400. The Phipps & Bird Stirrer, the solution feeder, a forthcoming stirrer using air for mixing, and all sorts of laboratory equipment for water and sewage plants. Bulletins and folders covering these pieces of equipment are complete and interesting. Phipps & Bird, Inc., 915 East Cary St., Richmond, Va.

Manhole Covers and Inlets

403. Nuisance from loose, noisy manhole covers is eliminated by the use of Westeel rubber cushioned manhole covers and gratings. Six special advantages are explained in a new illustrated bulletin just issued by the West Steel Casting Co., 805 East 70th St., Cleveland, Ohio.

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter, crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1¼ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Concrete

408. Concrete Pipe Sewers, a 28-page booklet, contains much valuable information and numerous illustrations on concrete pipe. Issued by American Concrete Pipe Association, 33 West Grand Ave., Chicago.

Pipe Forms

409. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

410. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

411. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

Taste and Odor Control

412. How, when and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Co., Inc., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

413. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

415. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

417. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Rubber Lined Pipes and Pumps

418. New, 68-page catalog describes Ace rubber lined pipe and fittings, hard or soft rubber lined centrifugal pumps and Ace hard rubber double acting pumps, for chemicals used in treating sewage and water and for acids and other corrosive liquids. Contains illustrations and specifications. Issued by American Hard Rubber Co., 11 Mercer St., New York, N. Y.

Run-off and Stream-Flow

420. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

421. The simple, automatic Loughlin, self-cleaning travelling screen is fully described in an interesting bulletin issued by Filtration Equipment Co., 10 East 40th St., New York, N. Y.

423. Sewage screens (Tark, Brunotte and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia, Pa. Books 1294, 1542 and 1587.

Setting and Testing Equipment for Water Meters

424. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

429. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons. Baltimore, Md.

Screens

430. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Bed Glass Covers

432. Sludge Bed Glass Covers—"Super-Frame." Hitchings & Co., Elizabeth, N. J. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

Sludge Incineration

438. A multiple hearth furnace which meets the most exacting municipal sanitary requirements for the incineration of sewage sludge—produces a fine ash or partially dry sludge for fertilizer—is described and illustrated with drawings and photographs in bulletins issued by Nichols Engineering and Research Corp., 40 Wall St., New York, N. Y. Operation as well as installation data is given.

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Sludge Removal Equipment

442. If you are interested in economical sludge removal, write for the latest bulletin describing and illustrating Louden Monorail equipment which is adapted to open or closed beds. Full details sent promptly by the Louden Machinery Co., 400 West Ave., Fairfield, Iowa.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 625 W. Lake St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

449. Installation views and considerable engineering data including capacity tables for settling tanks and layouts of typical arrangements for both final and primary tanks, are contained in a new booklet—No. 1542—just published for engineers by Link-Belt Company, 307 No. Michigan Ave., Chicago, Ill.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

452. Eliminate sludge bed troubles, forget about weather conditions, odor nuisance, hail insurance and the like. Full details as to how Oliver United Vacuum Filters overcome these problems will be sent to all interested by Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.

453. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill., and Philadelphia.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 247 Park Ave. New York, N. Y.

For the Engineer's Library

The editors will be glad to assist readers in getting copies of publications mentioned here.

Steel Sedimentation Basin:

The Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa., has issued a most interesting mimeographed and blue-printed description of their new steel sedimentation basin with internal spiral baffle. There is a lot of good dope on water purification plant design, and also on construction, using these steel tanks. Data on tanks up to 200-ft. diameter are given. You can get a copy by writing R. H. Beck at the above address.

Concrete Frame Construction:

Planning the job, erection cost analysis and concreting suggestions are three of the main topics in an excellent folder full of practical dope on cutting cost in concrete frame construction. Excellent forms for cost-keeping and planning, charts and illustrations. 12 pages. Sent on request to D. S. McBride, International Cement Corp., 342 Madison Ave., N. Y.

Conduit and Korduct:

The data in this 32-page booklet refer principally to conduits for electrical work, but it contains some interesting information on resistance to corrosive soils and electrolysis. Details of applications and types of fittings; also sizes and weights. Johns-Manville, 22 East 40th St., N. Y. Sent on request.

Gully Blasting:

New practices for uses of explosives in erosion control are covered in this 36-page booklet. Contents include: the problem of erosion, control of gully erosion, preparation of the soil, and gully bank grading; also some space is devoted to terracing farm lands and to tree cultivation. Photographs, line cuts and diagrams. DuPont, Wilmington, Del.

Properties of Cast Iron:

The "Strength and Elastic Properties of Cast Iron" by W. J. Schlick and B. A. Moore has been published as Bulletin 127 of the Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa. Deals with the strength and elastic properties of cast iron in combined tension and flexure, as well as in tension, compression and flexure. A valuable feature is the extensive bibliography of cast iron research and a review of the literature. No charge; sent on request.

Lighting Handbook:

Seven chapters or sections, covering interior lighting, built-in, display, sign, flood, underwater lighting and street and highway lighting. Lots of complete and authentic data. No data on number of pages. Book is 4x6½ inches; copies are available for 10 cents each from Commercial Engrg. Dep't., Westinghouse Lamp Co., Bloomfield, N. J.

Motors:

This is a tome that, on first inspection appears as complete and interesting as Mr. Webster's unabridged; but further inspection reveals that in the rear are some 18 or 20 pages of almost interesting and certainly valuable data on selecting motors and control, care of motors, drives, etc. The first 115 pages are largely drawings and dimensions tables with a few specifications scattered here and there. Write for catalog on Motors, 1936, to General Electric Co., Schenectady, N. Y.

Applied Mathematics:

By Martin E. Jansson. 754 pages., $6.

The publishers of this text have not sent us a review copy and this review is prepared from the publicity matter sent out by them. They say it is designed like an engineering handbook and arranged the same way. They further say "it is now possible for you to gain command of accurate mathematical methods without learning them in advance." Maybe so, but don't try working out Time-wasters that way. This volume, by the way, is the second edition, and the table of contents given shows it covers arithmetic, algebra, geometry, trigonometry and the mathematics of a lot of things, including concrete, sheet metal work, electricity, radio, print shop, lathing and plastering, plumbing, painting, paperhanging, etc. The publishers say it will be sent on approval.

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